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ENGINEERING NEWS.

RAILROAD EARNINGS for the first 7 months of 1889, reported to *Bradstreet's*, show the total gross earnings on 117 roads, with an extent of 73.140 miles, to have been $201,478,264, or an average per mile of $2,755. In 1888 the same roads reported a mileage of 70,183, and earnings for the first 7 months of $188,331,191, or an average per mile of $2 683. The increase over 1888 averages $72 per mile, or about 2¾ per cent.

The earnings by geographical divisions are as follows:

	1889 Earnings	1889 Mileage	1888 Earnings	1888 Mileage
10 Granger roads	$23,391,214	12 188	$24,970,426	11,959
43 Cent. W'n "	37.394,897	12,998	35,244,450	12 626
8 Eastern "	6 902,760	1,896	6,842,449	1,884
4 Trunk line "	32,877,854	5,423	31,776 832	5 369
30 Southern "	33,976,323	12 154	32,918,907	11,8 2
6 Pacific "	23,085,487	10,973	22,305,214	10,453
13 So'western "	29,470 932	14,256	27,583,815	13 694
3 Mexican roads	8.177.263	2,909	6,989,048	2.344
Total (117) "	$201,478.264	73.140	$188,331,191	70,183

For the month of July, 121 roads, show gross earnings of $30,292,163 against $28,076,277 for the same month last year. Of the whole number reporting, 28 showed a decrease over the preceding year, the whole amount of which was $553,038. The remainder reported increases amounting to $2,768,924, making the net increase $2,215,886.

ABANDONING UNPROFITABLE RAILWAY LINES is growing more frequent. The St. Paul, Minneapolis & Manitoba has not run trains over its line from Breckenridge to Barnesville, Minn., since the fall of 1888, and suit was brought before the State Railway Commission recently to compel the operation of the road. It was stated that the local business did not pay 10 per cent. of the cost of operating. The Commission reserved its decision.

THE NEW NAVY is certainly developing the shipbuilding industry of this country, and for the three 2,000-ton cruisers, bids for which are to be opened on Aug. 22, next, twelve responsible firms have sent in bids. The names of the firms which have already made application for plans and specifications for the 2,000-ton vessels are the Quintard Iron Works, New York; Union Iron Works, San Francisco, Cal.; the William Cramp & Sons' Building Company, Philadelphia, Pa.; the Hohenstein Manufacturing Company, Newark, N. J.; Harrison Loring, City Point Works, Boston, Mass.; Richmond Locomotive and Machine Works, Richmond, Va.; Neafie & Levy, Philadelphia, Pa.; The Continental Iron Works, Brooklyn, N. Y.; R. Moore & Co., Mobile, Ala.; Bath Iron Works, Bath, Me.; New York Iron Works, New York; and the Portland Locomotive Works, Portland, Me.

THE CITY OF PARIS broke the record east to Queenstown on her last trip, the actual sailing time being 5 days, 23 hours, and 44 minutes. The best westward record of this same ship, the best of any ship, was 5 days, 23 hours, and 7 minutes.

PUMP DREDGING has been adopted by Capt. F. A. MAHAN, U. S. Engineers, in the improvement of Erie harbor. The work is being done much after the practice of Capt. EADS at the Jetties, a powerful centrifugal pump being mounted on the stern of a steamer fitted with a large bin. A Worthington pump throws a jet to stir up the sand, etc., and the reported lift is 75 per cent. of solid material. About 75 cu. yds. of sand per hour is said to be lifted without difficulty.

THE ENGINEERS' CLUB of New York proposes to give a dinner on Sept. 2 to about 40 of the engineers returning from Europe. The membership of the club, we learn, is rapidly increasing, and as an organization of a purely social nature, to include all connected with any branch of engineering, is likely to be increasingly successful, especially as it will be quite as convenient to non-resident engineers, who are often in New York, as to residents.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a rear collision, Aug. 9, on the Rome, Watertown & Ogdensburg railway at Forest Lawn station. A local train was standing in the station and was run into by an express; the rear car of the local was telescoped and the express was derailed. Several persons were injured and three killed.——A head collision occurred August 12 at East Moorestown, N. J., on the Amboy division of the Pennsylvania railroad, and several persons were slightly injured. It is reported that the east-bound train had orders to stop at Moorestown and wait for the westbound train to pass, but the order was not obeyed. ——A train on the Montclair & Greenwood Lake railway was derailed near Bloomfield, N. J., Aug. 13. The engine ran into some freight cars standing on a side track, and wrecked two of them; the engine was overturned and one car was derailed. The accident is said to have been caused by a loose joint, the bolts of which had not been tightened up.

BRIDGE ACCIDENTS are reported as follows: The bridge on the Denver & Rio Grande, near Siloam Springs, Col., was burned Aug. 4. A derailed freight car damaged one truss of the Chesapeake & Ohio bridge at Cincinnati, last week. Railway bridges at Walnut Cove, N. C., on the Clinton branch of the Lehigh Valley, at Hot Springs, on the East Tennessee, Virginia & Georgia, and on the Denver & Rio Grande, have been washed away. Also highway bridges in Warren county, N. J., and Sussex county, Va.——Highway bridges have failed as follows: The Ann river bridge at Mona, Minn., gave way under a traction engine and thrashing machine; 1 man was killed. A bridge near La Harpe, Ill., gave way Aug. 4; 1 person was killed. A bridge near Liberty, Ind., gave way under a team with a load of lumber. A wooden bridge at Amherst, Mass., gave way under a team; this accident has induced the selectmen to have a thorough inspection made of all bridges over which heavy loads pass.

HEAVY RAINSTORMS have occurred in New York and Pennsylvania, also in Missouri, Colorado and New Mexico, causing damage to bridges and railways. A washout on the Sioux City & Pacific near Sioux City, Ia., derailed a fast passenger train.

THE PENNSYLVANIA RAILROAD COMPANY have decided to increase their works at Altoona, says a Philadelphia despatch. A new site has been chosen for a large number of shops to be erected. This ground is situated about two miles from the present works. There will be an erection, boiler, machine, and blacksmith's shops, boiler house, electric and hydraulic houses, office and storehouses, paint shop and paint storehouse. The works will be large enough to employ between 600 and 1,000 men, and the different shops are so erected that at any time they can be enlarged. The capacity of the new works will be 150 locomotives per year and will be capable of being extended to 500. It is also contemplated to erect another large foundry. The ground will be about 2,300 ft. by 780 ft.

CUBAN IRON MINES, in the Daiquiria mountains, 20 miles west of Santiago, are being examined by Minnesota capitalists with a view to development. The Pennsylvania Company and the Bessemer Steel Company already operate mines in the same region. The inducements are 64 to 68 per cent. metallic iron, labor at 80 cts. to $1.00 per day, and material admitted duty free for 15 years. There is an export duty, however, of 75 cts. per ton, says the Chicago *Herald*.

IRON PRODUCTION IN THE SOUTH, says the New Orleans *Times-Democrat*, has increased over 400 per cent. in the last 10 years. The total production in the nine iron States of the South was 744,669 tons for the first half of 1889, as compared with 2,000,651 tons for the rest of the country. From July, 1888, to July, 1889, the output was 1,245,584 tons in the South, as contrasted with 212,022 tons in 1879-80 for the same region.

SEA WATER FOR STREET WATERING is the subject of a paper lately read by Mr. S. H. TERRY before the Civil and Mechanical Engineers' Society, of England. Inquiries sent to the engineers of 35 coast towns which had been using sea water for this purpose showed that 23 towns had abandoned its use for various reasons. Ramsgate and Folkestone stated that it destroyed all kinds of road material except wood. Some towns advised its use in sewer flushing, in sufficient volume, but others thought it produced gases when brought into contact with the sewage. The testimony is in favor of sea water preventing dust on roads of flint or gravel; and Berwick-on-Tweed highly commends it for this purpose. It is there found that one cart of sea water is equal to two loads of fresh water in lasting effect.

ELECTRO MATRIX TYPE MACHINES are being perfected by S. S. SMALL and G. A. GOODSON, of Minneapolis. These machines are intended to produce a matrix from which stereotype plates can be cast directly. Each machine is only 30 ins. long by 6 ins. wide, and is worked on a table after the fashion of a typewriter. It is driven by a current from an ordinary incandescent electric light wire. An average of 25 words per minute is claimed as the speed of the machine.

THE VALUE OF GOOD ROADS can be better appreciated by those who digest the following notes of Prof. J. W. JENKS, in his "Road Legislation for the American State," on conditions in Illinois. It is there found that a full load can be carried on the State roads only three months during the year, two-thirds of a load three months, and half a load six months. Good dirt roads there would reduce the cost of hauling one half, and good permanent roads of macadam, three-fourths. The defective highways the State now possesses cost it an extra $15,346,230 for hauling, and depreciate the value of its farms $160,000,000. In other words, if it had a good system of roads, the farmers would be benefitted $160,000,000 in the value of their farms, and save $15,300,000 annually in hauling—a good interest on $255,000,000.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES, says *Le Génie Civil*, was, in 1887, obligatory in countries containing over 302,000,000 inhabitants. It is recognized by the law in countries comprising over 96,900,000 inhabitants, and is admitted in principle, and used in the customs, in countries of 395,000,000 inhabitants. Our contemporary sums up by saying that the metric system is legally recognized in the civilized world among over 794,000,000 people, an increase of 126,000,000 over the return for 1877, and including 61 per cent. of the population of the civilized world. In the second class above, are included England and its colonies, Canada and the United States; in the third class are included Russia, Turkey, and British India. China, Japan, and Mexico use different systems, decimal but not metric.

WORK ON THE NEW DENVER RESERVOIR is about being commenced by the engineers, Messrs. Land & Hawks, of Denver, Col. The dam will be 35 ft. high, 382 ft. wide on base and 100 ft. on top; the front slope is 1 in 3 and the back, 1 in 2½. It will flood 4,000 acres to a depth of about 30 ft., and stores 2,250,000 cu. ft., or the whole winter's flow and storm floods of the south fork of the South Platte river. We will shortly give more detailed information.

THE AMERICAN IRON AND STEEL ASSOCIATION has ascertained from reports from the manufacturers June 30, that the total production of Bessemer steel ingots in the United States, in the first half of 1889, amounted to 1,268,496 gross tons of 2,240 lbs. against 1,275,189 gross tons in the last half of 1888, and 1,235,971 tons in the first half of 1888. The Association also reports that the quantity of kinds and sizes of Bessemer steel rails rolled by the Bessemer steel producing works of the country in the first half of 1889 was 642,475 gross tons, against 673,724 tons in the last half of 1888, and 672,197 tons in the first half of 1888.

THE PARIS EXHIBITION has had, from May 3 to June 30, a total of 6,208,824 visitors. The total for the Exhibition of 1878, in the same period, was 4,322,358. From July 1 to 15, for this year, the attendance was 1,898,232, or over 1,000,000 more than in the same period in 1878.

THE HUDSON RIVER BRIDGE, at Peekskill, Gen. EDWARD SERRELL, Chief Engineer, is reported as having the east foundation completed and the west foundation well advanced. The river span will be 1,620 ft. long. The chief engineer has recommended that the contract for the "6,000 tons" of crucible steel wire for the main span be let to Bullivant & Co., of London, the best bidders, who promise to deliver the entire quantity in 11 months.

COAL LANDS of the Reading Railroad Co., 8,000 acres in extent and valued at $20,000,000, are claimed to be held by an imperfect title, and a suit has been brought by the Robert Morris Land & Coal Co., of New York, to tests its validity. Reading officials deny that the claimants have any standing either in law or equity.

THE SUTRO TUNNEL CO., on Aug. 4, conveyed to the Union Trust Co., of New York, all the property included in the sale of Jan. 14, 1889. This sale was made to satisfy a mortgage held by HUGH MCCALMONT and others. The Trust Co. bid in the property for $1,625,000.

THE ELECTRO-AUTOMATIC TRANSIT COMPANY, of Baltimore, made a trial run with their 3-ton motor on their experimental track at Laurel, Md., on Aug. 7. The track is a circle about 2 miles in circumference, and a speed of 2 miles per minute was attained by the motor.

THE OLIVE BILL has been practically defeated in the Railroad Committee of the Georgia legislature. The bill had for its object the prevention of railway consolidation, and punished attempts at consolidadation with forfeiture of charter. Much credit for the defeat of the senseless measure is due to the Atlanta *Constitution*, a journal which seems to have a clearest comprehension of the railway problem than any other Southern paper.

THE RECENT GEORGIA DUEL is of unusual interest from the fact that both the participants were prominent railway men and that the dispute which had to be settled by an appeal to the "code of (dis)honor" arose over the rivalry between opposing railway interests. Mr. J. D. WILLIAMSON is President of the Chattanooga, Rome & Columbus Railway and Mr. PAT. CALHOUN is chief counsel of the Richmond & West Point Terminal Company, and, according to common report, is booked to succeed Mr. JOHN H. INMAN as President of that powerful corporation. The rivalry between these two corporations led to considerable personal feeling between their representatives, which seems to have vented itself in insulting speeches. The two men have shown themselves to be surprisingly deficient both in marksmanship and good sense.

THE BALTIMORE & OHIO SHOPS at Wheeling, W. Va., have been closed, probably permanently.

The Standard of Time—The Twenty-Four O'Clock System.

The 24-o'clock system has always been in use for scientific purposes where exactness is required. The manifest and growing objections to the present division of the day into halves and twelfths, for travelers and in the making and interpretation of time-tables, has led to many attempts to improve the system by the adoption of a more convenient method. Without going into the consideration of the merits of the different plans that have been proposed, it will at once be acknowledged that any improvement, to practically succeed in general

Fig. 1. Mechanism of Kosmic Dial.

use, must be simple, and contain no radical departure from the established custom. Such is the 24 o'clock plan, which is gradually and quietly making its way into general use.

The day is only a local phenomenon. Time is only accurately determined by the motions of the planets. The natural divisions determined by these are the year, month, and day. Taking the mean solar day for the standard, or unit, and midnight on some fixed degree of longitude on the earth, as that of Greenwich, for the starting-point, if the earth is divided around its circumference into 24 parts, corresponding to the 24 hours of the day, an absolute standard of time for the whole world is secured, and this is called Kosmic time.

Fig. 2. Top View of a Kosmic Table Clock.

Presented by Sigismund the Great, King of Poland, to his Queen Bona Sforza, A. D., 1525; now in possession of the Society of Antiquaries, London.

By this arrangement the earth itself becomes the great standard chronometer for all mankind, and in its daily rotations the sun at any point will be the index of Kosmic time. For example: when the seventeenth-hour meridian, which governs the local time of New York or Boston, is under the sun, it is 17 o'clock, Kosmic time; when the eighteenth-hour meridian, which governs the local time of Chicago, is under the sun, it is 18 o'clock; when the nineteenth-hour meridian, which governs the local time of Denver, it is 19 o'clock; when the twentieth-hour meridian, which governs the local time of San Francisco, is under the sun, it is 20 o'clock Kosmic time; and so on, all around the earth.

Kosmic time indicates universal time, based on the prime meridian, which is Greenwich. Each of the 24 meridians into which the earth is divided then becomes in time just 1 hour apart, as astronomers divide the heavens. It becomes then the time of the universe, the one measure of motion. Its hours are counted from 1 to 24 by meridians of longitude around the earth, passing in succession under the sun. These meridians are standards for local time.

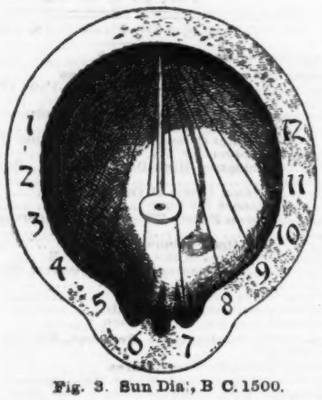


Fig. 3. Sun Dial, B. C. 1500.

The only change from the present method of reckoning involved in the use of this standard is to count the hours from 1 to 24, instead of from 1 to 12 twice each day. The advantages in simplicity and accuracy are obvious. How to introduce this change practically, in clocks and watches, was the

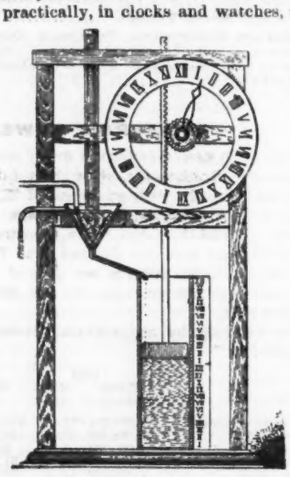


Fig. 4. Water Clock, B. C. 200.

only problem to solve. The construction and operation of the Kosmic dial is as follows: A series of radial spindles, loosely journalled at both ends, Fig. 1, carry numeral blocks and turnstiles. The

Fig. 5. Watch Dial in Common Use, A. D. 1500.

numerals are so arranged as to appear in their proper order when the blocks are turned. disk, mounted on the hub of the hour-hand, keeps the numeral blocks in line with the face-plate. It has a notch in its circumference with a projecting pin, which passes through each turnstile in succession

once in 12 hours, thus turning the spindles, with their numeral blocks, one-fourth of a revolution.

The power required is infinitesimal, and is taken direct from the central power of the time-piece.

The Kosmic dial is the only method by which local and Kosmic time can be shown simultaneously on a dial of 12 divisions. The regular hour-hand indicates local time; the small hour-hand indicates Kosmic time.

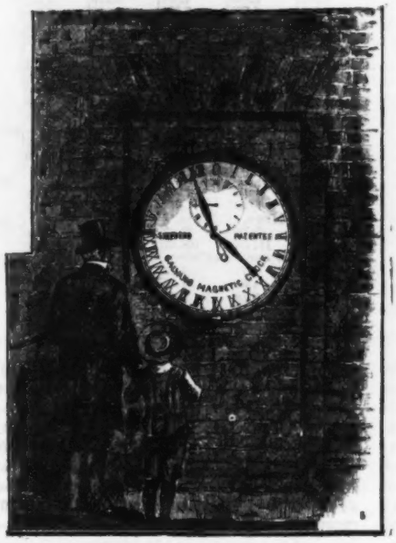


Fig. 6. Clock at the Entrance of the Royal Astronomical Observatory at Greenwich. "The Time Regulator of the World.

The railway companies of North America adopted this system as the basis of standard time in November, 1883, and now decidedly approve of its practical application to their time-tables and to the dials of clocks and watches.

Fig. 7 Plan of Standard Time now in General Use in North America.

It is now in use on the Intercolonial Railway, for certain through trains on the Canadian Pacific, and its adoption is extending to other railroads. A report favorable to the adoption of this standard was made by a committee of the American Society of Civil Engineers, of which Mr. SANDFORD FLEMING, who has for eight or nine years taken an active interest in advancing the new reform, was a member.

The meridian of Greenwich, England, was established as the Prime Meridian for longitude, and a "universal day," beginning for all the world at Greenwich, midnight, with the hours numbered in a single series from 1 to 24, was adopted by the leading nations of the world, in a conference at Washington, in October, 1884.

Among the many efforts made by clock and watch manufacturers and others, the Kosmic dial alone interprets the system with the least possible mental and mechanical friction.

It does not change the general appearance and time mechanism of clocks and watches. A procession of Roman numerals from I to XII, followed automatically by a like procession of Arabic numerals from 13 to 24, the two sets taking their places in orderly and unvarying succession, presents to the public eye, in its simplest and clearest expression, precisely the information needed at any hour of the day or night. The removal or insertion of the pin that changes the figures gives the choice between the old and the new systems in a single time-piece.

It is said that about 4,000,000 clocks and watches are manufactured annually, in the United States. To change either the time or mechanism, or even the general appearance of clocks and watches, would be a herculean task. This is not at all necessary with the new standard. Any clock or watch can be readily fitted with the new dials, and the relative positions of the numerals in present use are not changed.

Among those working to bring this standard into general adoption are, besides Mr. FLEMING, Mr. W. F. ALLEN, editor of the "Traveller's Official Railway Guide," Prof. CHARLES F. DOWD, Mr. JOHN SWAN, and Mr. HENRY E. WAITE, of Boston. Clocks, provided with the turning figures will soon be manufactured for the market, and sample clocks have already been made in considerable variety. It is intended to provide the Boston Post Office with one of these clocks, made in the shape of a globe and hung in Post Office Square, for the better education of the public.

Figs. 3, 4, and 5 show ancient time-keepers; Fig. 6, is the great mean solar standard clock, the time regulator of the world; and Fig. 7, the plan by which the earth itself becomes the standard of time.

The New Class of Transatlantic Steamships.

Every year the number of Americans who take the trip across the Atlantic, and the number of Europeans who visit the United States, becomes greater; and the competition between the different transatlantic steamship companies is leading to as great changes in ocean travel as those which have taken place in journeying on the land. As noted in our issue of May 18, the last 50 years have reduced the time of transit between Liverpool and New York from 18 days to 6 days less one hour; and in the still more important point of safety and comfort, equal or greater progress has been made. The new class of transatlantic liners not only promises to reduce the voyage across the Atlantic an average length of at least a day over the ordinary time of ten years ago, but to excel the once famous *Arizona* and *Alaska* and vessels of that class as much in safety and luxury as the palace cars on the New York and Chicago Limited excel the ordinary first class coaches.

To the Inman line belongs the credit of putting into commission the first of this new class of steamships. The *City of New York*, although not so speedy a vessel as was expected, was a revelation to ocean travellers of the possible luxury which money can provide in a transatlantic voyage. The disappointment at her failure to lower the record for speed was fully recompensed when her sister ship, the *City of Paris*, on her second trip across the Atlantic, beat the record which the *Etruria* had made in 1888 by 2 h. 48 min.

Hardly had the excitement over this remarkable performance subsided when the announcement came of the somewhat unexpected success of another competitor in the new class of ocean greyhounds. The Hamburg-American Packet Company, organized in Germany in 1847 to operate a line of sailing ships, undertook steamship operation in 1854, and now has a fleet of 37 ocean steamships plying between New York and Baltimore and ports in the West Indies, South America, England, France, and Germany. The four new steamships which are to operate the company's Atlantic express line will ply between New York and Hamburg via Southampton, England. The first of these, the *Augusta-Victoria*, arrived at New York May 19, having made the fastest maiden trip across the Atlantic on record. Her time between Fastnet and New York was 6 d., 8½ h. Her sister ship, the *Columbia*, as noted last week, on her second trip across made the remarkable time of 6 d. 19 h. 19 min., 36 sec.

The vessels just described, although so fast and luxuriously fitted, are considerably inferior in point of size to the largest transatlantic liners already afloat. The two new ships which are soon to be added to the fleet of the White Star line will excel in length any vessel now afloat, except the elephantine *Great Eastern*, 680 ft. in length. The *Teutonic*, which made her maiden trip across the Atlantic this week, is the first merchant vessel to comply with the requirements of the British Admiralty for an armed cruiser; and she receives, therefore, a handsome subsidy, in consideration of which she will be at the disposal of the British Government in case of war, carrying an armament of 12 guns. The *Teutonic* was built at Belfast by Harland & Wolff. She is 582 ft. long (nearly one-ninth of a mile), 57 ft. 6 ins. deep, and 39 ft. 4 ins. beam. Her gross tonnage is 9,685. Her engines are triple expansion, designed to develop 17,000 indicated horse power. The cylinder diameters are 43 ins., 68 ins., and 110 ins., with a stroke of 5 ft. Steam is supplied by 12 boilers from 12 ft. to 12 ft. 6 ins. in diameter, and the working pressure is 180 lbs. The total grate area is 1,163 sq. ft. The twin screws are each 21 ft. 6 ins. diameter, with a pitch of 28 ft. 6 ins., and total blade area of 128 sq. ft. They overlap each other 5 ft. 6 ins., and the port propeller is placed 6 ft. forward of the starboard. The propeller shafts are 199 ft. and 205 ft. in length. The port propellor is left-handed and the starboard propeller is right-handed. Thus both work away from the ship, and the port propeller, working in the loose water of the other screw, makes two revolutions a minute more than its twin.

In this ship, as indeed in all the new class of fast transatlantic liners, the whole machinery is in duplicate, and the engine, boilers, and machinery working each screw are wholly independent of the set working the other, and are separated therefrom by a staunch fore and aft bulkhead running from the after engine room to the foremost coal bunker, and cutting in half the six largest water tight compartments. There is only one door through this, and this is kept locked and the key is put in possession of the chief engineer. Thus in case of accident to either set of machinery, the other goes on, and can drive the ship at about two-thirds of her regular speed. Besides this bulkhead the usual transverse bulkheads are provided, dividing the ship into water-tight compartments. The *Teutonic* has 11 transverse bulkheads. The doors between the engine-rooms and the stoke-holes are duplicated, and the duplicate door can be operated by the captain from the deck. When liberated, they close by their own weight, and in the event of water flowing into the compartment a hollow float is lifted, releasing the catch and letting the door fall. All the machinery in the *Teutonic* is below the water line, according to the Admiralty requirement. She has accommodations for 300 first-class, 150 second-class, and 750 steerage passengers.

To compare these new vessels more readily, we give the following table of the principal dimensions of one boat of each line:

	City of New York.	*Columbia.*	*Teutonic.*
Length, ft.	568	470	582
Breadth, "	63½	64	57½
Depth, "	42	39½	39½
Tonnage,	12,000	10,000	9,685
H. p. Power.	19,000	17,000	17,000
Cyl. diameters, ins.	43-74-113	40-66-101	43 68-110
Stroke,	4 ft.	5 ft. 6 ins.	5 ft.
Screws, diam.	22 ft.	18 ft.	21 ft. 6 ins.
" pitch,	28 ft.	32 ft.	28 ft. 6 ins.
Grate surface, sq. ft.	1,250	1,200	1,163

Builders, J. & G. Thompson, Laird Bros., Harland & Wolff.

Since the above was in type the *City of Paris*, of the Inman line, has reduced the east bound record to 5 d. 23 h. 44 min. The *City of New York* of the same line arrived at New York Aug. 15, having made the passage in 6 d. 14 h. 45 min. The *Teutonic* arrived an hour later, having made the run in 6 d. 14 h. 23 min., thus showing better time on her maiden trip than was made by either the *City of New York* or *City of Paris*.

Besides the *Columbia* and *Augusta-Victoria*, the Hamburg-American company have two more vessels, of similar type but considerably larger, now under way, one on the stocks of the Vulcan Shipbuilding Co., at Stettin, Germany, and the other at the yards of John Elder & Co., the builders of the *Etruria* and *Umbria*. One will be ready for service in about 8 months; the other probably in May, 1891.

The White Star line will soon have another ship, the *Majestic*, similar to the *Teutonic*, and built at the same yards. It is probable that the Cunard line, the Anchor line, and the Guion line, will not allow themselves to be eclipsed by their rivals, and that new ships, taking rank with those above described, will be added to their fleets.

Railways of the United States in 1888.

From advance proofs of the introduction of the forthcoming 1889 issue of Poor's *Manual* we make the following extracts. We have reviewed some features of the report in another column.

TABLE 1.

LENGTH OF LINES OWNED, SHARE CAPITAL, FUNDED AND OTHER DEBTS, LENGTH OF LINES OPERATED, GROSS AND NET EARNINGS, AND INTEREST AND DIVIDENDS PAID, BY ALL THE RAILWAY COMPANIES OF THE UNITED STATES FOR THEIR RESPECTIVE FISCAL YEARS FROM 1871 TO 1888, INCLUSIVE.

All in Millions of Dollars.

	L'gth of Line Own'd.	Stock.	Bonds.	Oth'r Dts.	L'gth of Line Op'r'd.	Earn'g Gr.	Earn'g Net	Int. Pd.	Divs. Pd
	M.	$	$	$	M.	$	$	$	$
1871	51,445	+2,664	....	....	44,614	400	141	....	56
1872	57,323	1,647	*1,511	....	57,323	465	165	....	64
1873	70,651	1,947	*1,836	....	66,237	526	183	....	67
1874	72,623	1,990	*2,230	....	69,273	520	189	....	67
1875	74,096	+4,658	....	....	71,759	503	185	....	74
1876	76,305	2,248	2,165	55	73,598	497	186	93	68
1877	79,208	2,313	2,255	237	74,112	472	170	98	58
1878	80,832	2,262	2,297	182	78,960	490	187	103	53
1879	84,393	2,395	2,319	156	79,009	525	216	112	61
1880	92,147	2,708	2,530	162	82,146	615	255	107	77
1881	103,530	3,177	2,878	222	92,971	701	272	128	93
1882	114,461	3,511	3,235	270	104,971	770	280	154	102
1883	120,552	3,708	3,500	268	110,414	823	263	173	102
1884	125,152	3,762	3,669	244	115,672	770	268	176	93
1885	127,729	3,817	3,765	259	123,320	772	269	187	77
1886	133,606	3,999	3,882	280	125,185	829	340	189	81
1887	147,999	4,191	4,186	294	137,028	940	334	203	91
1888	154,276	4,438	4,624	307	145,387	900	301	207	80

NOTE.—* includes funded and other debt, and + includes total capital and debt accounts. Owing to the incompleteness of the information at hand, the statistics of "other debt" and "interest paid" cannot be furnished for the first five years covered by above statement.

TABLE 2.

AVERAGES PER MILE OF STOCK, BONDS, COST, AND EARNINGS, PERCENTAGE OF EXPENSES TO EARNINGS, EARNINGS PER PASSENGER TRAIN MILE AND PER FREIGHT TRAIN MILE, PER PASSENGER MILE, AND PER TONNAGE MILE, ETC., ALL FOR U. S. RAILWAYS, FOR 1883, 1884, 1885 1886, 1887 and 1888:

	1888	1887	1886	1885	1884	1883
	$	$	$	$	$	$
Capital Stock per Mile of Completed Road	28,748	28,321	29,935	29,867	30,064	30,759
Bonded Debt per Mile of Completed Road	29,972	28,290	29,062	29,453	29,317	28,950
"Cost of Road and Equipment" p. M. of Com. Rd	54,088	52,699	54,301	55,029	55,329	55,461
Passenger Earnings per Mile of Road in Operation	1,723	1,726	1,693	1,612	1 601	1 951
Freight Earnings per Mile of Road in Operation	4,397	4,649	4,397	4,219	4,302	5,168
Gross Earnings per Mile of Road in Operation	6,540	6,861	6,570	6,265	6,662	7,461
Net Traffic Earnings per Mile of Road in Operation	2,045	2,444	2,376	2,185	2 3.8	2 763
Percentage of Expenses to Earnings	68.72	64.45	63.84	65 12	65.21	68.78
	$	$	$	$	$	$
Passenger Earnings per Passenger Train Mile	0.937	1.008	1.006	0.949	1,001	1.11
Freight Earnings per Freight Train Mile	1.557	1.615	1.573	1.518	1,702	1.56
Gross Earnings per Revenue Train Mile	1 398	1.445	1 443	1.366	1.410	1.50
Gross Expenses per Revenue Train Mile	0 948	0 931	0 921	0 92	0.9 8	0.96
Net Earnings per Revenue Train Mile	0.432	0.514	0.522	0.474	0.492	0.54
	per cent	per cent.	per cent	per cent.	per cent.	per cent.
Passenger Earnings—Proportion of Gross	26 44	25.82	25.77	26.9	27.1	26
Freight Earnings—Proportion of Gross	67.24	68.58	66.94	67.4	65.9	67
Other Earnings—Proportion of Gross	6,32	5.80	7.29	5.7	7.0	7
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Earnings per Passenger per Mile	2.246	2.276	2 181	2.168	2 356	2.422
Earnings per Ton per Mile	0.907	1.034	1.042	1.057	1,124	1.236
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Average Distance per Pass	24.78	24.68	25.27	25 99	26.24	27.32
Average Haul per Ton	119.48	111.51	109.49	112.46	112.07	110.04
	per cent.	per cent.	per cent	per cent	per cent.	per cent.
Interest per cent. of Bonds	4.35	4.71	4.75	4.77	4.66	.....
Interest per cent. of Bonds and Debt	4.17	4.55	4.53	4 62	4.51	4.59
Dividends per cent. of Stock	1.77	2 18	2 04	2.02	2.48	2.75
Interest and Div'ds per cent. of Stock, Bonds, and Debt.	3.03	3.40	3.26	3.36	3.52	3.68

connection with that single interest; and if to this number we add 780,000—a number representing an average of five to the mile—as the number of persons employed in connection with all those industries which are directly affiliated with and dependent on our railway system, such as locomotive and car building establishments, rail mills, etc., etc., we have a total of nearly 1,716,000, or an average of 11 to the mile of railroad. Assuming that each of these would represent a family averaging five persons, we have an aggregate population of 8,580,000—nearly one-seventh of the total for the country at large—of which 90 per cent. are actually dependent on the railway system for the sustenance of life. If time for the completion of a mile of railroad to be 67 days. On this basis the construction of 12,984 miles of railroad would give steady employment for 300 days in the year to an army of 289,976 laborers, whose total earnings would be $129,840,000.

This gives a total of 2,006,000 persons, to which we will add 44,000 as the number whose labors are stimulated by the employment of the 289,976 last mentioned, making a total of 2,050,000, representing families numbering in the aggregate 12,250,000 persons. To maintain this number there would be expended by railroads and others under the above calculations at least $1,040,000,000 per annum, or very nearly $3,000,000 for each day in the year. The regu

TABLE 3.

COMPARATIVE STATEMENT SHOWING BY GROUPS OF STATES THE AVERAGES PER MILE OF STOCKS, BONDS, COST, EARNINGS, PERCENTAGES OF EXPENSES, ETC., ETC., FOR THE TWO YEARS 1887 and 1888:

	New England		Middle		North Central		So. Atlantic		South Central		Southwestern		Northwestern		Pacific	
	1888	1887	1888	1887	1888	1887	1888	1887	1888	1887	1888	1887	1888	1887	1888	1887
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Pass. earnings p. m. of road in operation	4,567	4,263	3,490	3,373	1,515	1,563	1,032	937	1,251	1,247	1,068	1,135	1,128	1,079	1,801	1,699
Freight do do do do	5,128	4,910	10,069	9,696	4,028	4,509	2,616	2,431	3,334	3,710	2,812	3,363	3,242	3,320	4,102	3,820
Gross do do do do	10,239	9,711	14,775	13,560	5,941	6,479	3,893	3,740	4 909	5,274	4,159	4,873	4,65	4,7-9	6 626	6,505
Net traffic do do do do	2,557	2,821	4,976	5,067	1,721	2,284	1,057	1,163	1,668	1,817	1,027	1,676	1,718	1,844	2,346	2,455
Per cent. of expenses to earnings	75 03	70.96	68.44	62.78	70 54	64.74	72.89	68.91	66.44	65 55	75.19	65.61	62.99	61 48	64.91	60.44
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Pass. earnings p. passenger train mile	1.193	1.221	0.812	0.961	0.868	0.913	0.812	0.898	0.863	0,899	0.941	1.068	1.127	1.201	1.707	1.448
Freight earnings p. freight train mile	1.717	1.703	1.607	1.677	1 309	1.385	1 007	1.532	1.488	1 625	1.629	1.788	1.941	1.967	2.781	2.276
Gross earnings p. revenue train mile	1.491	1.473	1.328	1.4-9	1.214	1.286	1 3:8	1.508	1.293	1.401	1.466	1.677	1.183	1.818	2.269	2 147
Gross expenses p. revenue train mile	1.119	1.045	0.857	1.-91	0.853	0.833	0.857	0.953	0.857	0.918	0.963	1.109	0 569	1.108	1.346	1.298
Net earnings p. revenue train mile	0 372	0.428	0.469	0.528	0.357	0.453	0.469	0.355	0.436	0.483	0.363	0.577	0 614	0.710	0.923	0.849
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c	p. c.	p c.	p. c.
Pass. earnings—p. c. of gross	44.60	43.80	24.29	25.18	25 54	24.12	24 28	26.51	25.18	23 65	24.17	23.29	24.30	22 86	26.93	27.38
Freight earnings—p. c. of gross	50 07	50.56	71.52	72 30	66 78	69.59	71.52	67.19	67.12	70.34	67.93	69.02	69 77	70.33	61.35	61.56
Other earnings do do	5 33	5.55	4.19	2.46	6.68	6.29	4.19	6.30	7.70	6.01	7 90	7.69	5.93	6.81	11.72	11 06
	Cts	Cts	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Ct.	Cts.	Cts.	Cts.
Earnings per passenger p. mile	2.008	1.964	2.024	2.092	2,143	2.274	2,024	2 108	2.482	2.421	2,514	2 824	2 593	2,662	2.472	2.277
Earnings per ton per mile	1.522	1.566	0.833	0 908	0.811	0 854	0.833	1.188	1.085	1.242	1.474	1.529	1.214	1.288	1.895	1.577
	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles
Average distance per passenger	15 30	15.85	15.29	17.35	35.08	34.68	15.29	34.52	35.89	38 55	46.77	5o.15	43.33	45.50	38 68	38.08
Average haul per ton	62.78	61.35	88.80	80.03	131 08	140 34	88.80	100.54	98.19	102 47	138 41	149.18	180 18	161 18	174 01	171.56
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
Interest per cent. of bonds	4 82	4.59	4.59	5.39	4 51	4.53	4 59	3.53	3 08	3.90	4.21	4.03	3 94	4.75	5 39	5.94
Dividends per cent of stock	4 56	4.51	2.52	2.68	2.37	2.91	2.52	0 63	0 78	0.23	0.83	1 86	0 58	0.97	0.42	0.71
Int and div. p. c. of stock, bonds, and debt.	4.54	4 43	3.45	3.95	3.39	3.75	3.45	2.07	2.06	2.18	2.48	2.81	2.40	2.85	2.76	3.18

By examination of the above table it will be found that stock and bond capitalization averages largest per mile in the Middle group and smallest in the South Atlantic group. The average cost per mile is greatest in the Middle group; the Pacific group comes second and the New England group third, the South Atlantic being lowest in this also. Gross earnings attained the largest average per mile in the Middle group, followed by the New England, Pacific, Central Northern, Gulf, Northwestern, Southwestern and South Atlantic groups in the order given. Net earnings were in the same general order. The percentage of expenses to earnings was lowest in the Northwest and highest in the Southwest. The highest rate received per passenger mile was in the South Atlantic group; the lowest in New England. The highest rate per ton-mile was in the Pacific States; the lowest in the Middle group.

In point of importance, the railroad interest now takes precedence of all other industries or enterprises. Its magnitude is greater than that of any other interest in the world, and it has become so thoroughly a part of the economic system of the Republic as to be second only to the Government itself.

In order to show how closely interwoven are the interests of railroad stockholders and the working classes of the country, a few calculations are herewith submitted.

If we estimate that in the operation of our railways there are employed in prosperous times an average of six persons per mile of road, it would show a total, on the basis of our present mileage, of more than 936,000 persons regularly employed in we allow, as the average rate of wages of those employed in operating, say $450 per annum, and for those employed in locomotive building, etc., say $500 per annum, we have a total pay-roll of $911,200,000 per annum, of which at least $500,000,000 is directly chargeable to operating account, while the remainder is for account of betterments, improvements, and new construction. Add to this the amount paid to laborers engaged in construction in such a year as 1887. In that year there were built new roads whose aggregate length was 12,984 miles. If we take, as the average cost of labor in grading, tracklaying, etc., for each mile of this total, say $10,000, and allow the average daily wages of laborers to be $1.50, with, say, 100 laborers of all classes to each mile, this would show the average lar expenditure of more than 90 per cent. of this vast sum stimulates other industries, and in this manner the volume of general business is increased in progressive ratio.

In these calculations no account has been taken of the large number of people forming the proprietary interest of this vast aggregation of capital, which comprises people in all classes and in all occupations, and scattered throughout all parts of the country.

The New York Central Railway Co. has 10,000 stockholders, whose average holding is about $9 000. If we take that sum as representing the average holding of all stock and bondholders in the country, the total number of such would be over 1,000,000, representing more than 5,000,000 persons with im

TABLE 4.

AGGREGATE NUMBER OF TONS OF FREIGHT MOVED, AGGREGATE FREIGHT EARNINGS, AND AGGREGATE TON-MILEAGE, AND AVERAGE RATE PER TON PER MILE FROM 1865 TO 1888.

Pennsylvania, Pittsburg, Fort Wayne & Chicago, New York Central, Lake Shore, Michigan Central, Boston & Albany, and New York, Lake Erie & Western Railroads.

Year	Tons Moved. 1=1,000	Aggregate of Earnings 1=1,000	Aggregate for each Yr. 1=1,000	Rate per Ton per Mile.
	Tons.	$	*Ton miles.*	*Cents.*
1865	11,151	47,832	1,649,316	2.900
1866	14,049	51,876	2,044,416	2.503
1867	15,594	52,074	2,258,216	2.305
1868	17,468	54,199	2,541,578	2.132
1869	20,536	58,826	3,159,832	1.800
1870	21,456	58,732	3,685,824	1.593
1871	25,008	64,168	4,340,131	1.478
1872	28,634	76,469	5,081,263	1.504
1873	32,817	85,100	5,762,062	1.476
1874	32,899	78,330	5,879,662	1.332
1875	32,956	68,919	5,935,242	1.161
1876	36,106	66,395	6,739,527	.985
1877	39,133	63,509	6,536,997	.971
1878	39,124	70,581	7,855,222	.898
1879	48,585	73,313	9,594,719	.764
1880	53,937	88,792	10,313,056	.860
1881	62,616	88,210	11,569,001	.763
1882	64,948	84,006	11,191,066	.756
1883	60,695	93,913	11,326,271	.829
1884	64,397	79,401	10,719,521	.740
1885	66,521	72,138	11,331,309	.636
1886	74,517	84,761	11,915,435	.711
1887	84,754	97,357	13,543,351	.718
1888	90,246	90,383	13,858,488	.609

Illinois Central, Chicago & Alton, Chicago & Rock Island, Chicago, Burlington & Quincy, Chicago & Northwestern, and Chicago, Milwaukee & St. Paul Railroads.

	Tons.	$	*Ton miles.*	*Cents.*
1865	4,032	18,703	513,421	3 642
1866	4,803	19,957	576,988	3 459
1867	6,303	24,389	768,171	3.175
1868	7,064	28,198	893,856	3.451
1869	8,071	31,911	1,054,559	3.026
1870	8,540	29 919	1,234 678	2 423
1871	9,391	30,947	1,233,058	2.509
1872	10,592	31,074	1,337,038	2.324
1873	11,956	37,629	1,719,496	2 188
1874	12,637	40,004	1,851,645	2.160
1875	12,662	37,699	1,904,937	1.979
1876	13,488	37,449	1,994,712	1.877
1877	13,364	36,799	2,211,021	1.664
1878	15,705	41,666	2,8 2,885	1.476
1879	18,807	44,410	3,470,822	1.279
1880	24,212	57,551	4,167,610	1 389
1881	27,076	63,007	4,498,641	1.405
1882	29,851	68,702	5,040,239	1.364
1883	31 663	75,565	5,768,109	1.310
1884	32,573	74,353	6,093,282	1.220
1885	34,348	75,307	6,500,185	1.158
1886	35,690	75,667	6,806,148	1.111
1887	40,276	78,890	7,776,436	1.014
1888	41,767	74,429	7,968,729	0.934

TABLE 5.

Rolling stock of Railroads in the United States: 1877 to 1888.

Year.	Locomotive Engines.	Revenue Cars. Pass'ger.	Bagg'ge, Mail and Express.	Freight.	Total.
1877	15,911	12,053	3,854	302,175	408,082
1878	16,445	11,683	4,413	423,013	439,109
1879	17,084	12,009	4,519	480,190	496, 18
1880	17,949	12,749	4,786	539,255	556,930
1881	20,116	14,548	4,976	648,295	667,819
1882	22,114	18,551	5,566	730,451	751,568
1883	23,623	16,869	5,848	778,663	801,407
1884	24 567	17 363	5,911	798,399	821,613
1885	25,937	17,250	6,044	805,510	828,853
1886	26,415	19,282	6,325	845 914	871,491
1887	27,643	20,457	6 554	950 887	977 898
1888	29,308	21,425	6,827	1,005,116	1,033,368

portant interests in the success of the railroad system.

From these deductions a general idea can be gathered of the magnitude of the railroad interest, and how vast and widespread is the interest of our people in that system.

ENGINEERS' DAILY REPORTS FOR ELECTRIC RAILWAYS, ETC.—A handy and labor-saving series of blanks for use at electric stations, etc., is issued by HOWARD CHALLEN, 10 Spruce St., New York. These records are in the form of pads of 31 leaves each and are ruled and printed for 6 engines. The headings indicate the hours of starting and stopping, revolutions, vacuum, received pressure, horse-power, temperature, water, fuel, oil, waste, etc. The price is 50 cts. per pad, or 12 pads for $4.00. They seem well adapted for the purpose intended.

TABLE 6.

Area, Estimated Population, Railway Mileage and Assessed Valuation in the several States, and their relation one to another, on December 31, 1888:

States.	Area Square Miles.	Estimated Population. Total.	Per sq. Mile.	Miles of Railro'd.	One Mile of R. R. To sq. Miles.	To Inhabit'ts.	Assessed Val'uti'n. Gross.	Per Cap.
Maine	33,040	660,139	19.98	1,321.34	25.00	499.59	$ 235,978,716	$ 357
New Hampshire	9,305	346,000	37.18	1,079.49	8.62	320.52	252,570,804	730
Vermont	9,565	333,000	34.81	958.55	8.67	348.45	160,588,155	482
Massachusetts	8,315	2,078,625	249.9	2,074.32	4.08	1,002.08	1,932,548,801	929
Rhode Island	1,250	304,284	243.4	214.21	5.85	1,420.49	428,530,55	1,079
Connecticut	4,900	670,000	136.74	1,006.46	4.86	665.70	352,795,920	526
New England Group	66,375	4,392,042	66.17	6,654.37	9 97	660.02	3,363,012,969	743
New York	49,170	6,500,000	132.19	7,595 54	6.47	855.77	3,469,199,945	533
New Jersey	7,815	1,463,404	187.25	1,980.73	3.95	738.82	586,917,860	401
Pennsylvania	45,215	5,400,000	119.43	8,224.51	5.49	656.57	429,751,584	79
Delaware	2,050	150,000	73.17	314.76	6 51	476.55		
Maryland	12,210	1,100 000	90.09	1,185 40	10.32	929.53	490,016,183	445
District of Columbia	70	230,000	3,142,86	20.66	3 39	10,648 60		
Middle Atlantic Group	116,530	14,823,404	127.29	19,319.69	6.03	767.79	4,975,885,072	344
Ohio	41,060	4,500,000	109.59	7,638.27	5.37	588.67	1,705,182,719	379
Michigan	58,915	2,195,602	37.26	6,499.45	9.06	337.67	945,040,000	430
Indiana	36,350	2,500,000	68.77	5,890 26	6.17	424.43	769,747,000	304
Illinois	56,650	3,750,000	66.19	9,900.50	5.72	378.77	797,773,002	213
Wisconsin	56,040	1,700,000	30.34	5,329.62	10.51	318.97	581,284,749	342
Central Northern Group	249,015	14,645,000	58 81	35,256.10	7.07	415.69	4,798,987,470	328
Virginia	42,450	1,700,000	40.05	2,931.22	14.48	580.64	396,711,325	533
West Virginia	24,780	800,000	32.28	1,281.04	19.29	622.60	179,385,389	224
North Carolina	52,250	1,650,000	31.58	2,528.58	20.66	652.69	211 944,271	129
South Carolina	30,570	1,350,700	44.18	2,083.97	14.67	648.12	141,074,347	105
Georgia	59,475	1,752,711	29. 7	3,928.42	15.14	445.02	357,167,458	204
Florida	58,680	450,000	7.94	2 249.78	26.08	200 03	86,255,662	192
South Atlantic Group	268,205	7,703,411	28.71	15,003.01	17.87	513 45	1,372,548,392	178
Kentucky	40,400	2,200,000	54.45	2,584.93	15.64	851.07	583,052 970	178
Tennessee	42,050	1,700,000	40.43	2,467.64	17.03	698 81	329,495 556	194
Alabama	52,250	1,500,000	28.71	2,985.64	17.50	502 .38	214,925,869	143
Mississippi	46,810	1,300,000	27.77	2,247.72	20.82	578.25	129,887,254	100
Louisiana	48,730	1,100,000	22.58	1,504.57	32.36	730.80	207,000,000	188
Gulf & Mississippi Valley Group	230,230	7,800,000	33.88	11,790.50	19.52	661.57	1,444,361,449	185
Missouri	69,415	2,750,000	39.62	5,900.89	11.76	466 03	789,692,245	287
Arkansas	53,850	1,140,000	21.17	2,985.67	26.32	557 .22	148,259,654	130
Indian Territory	64,690	125,000	1.93	975.17	66 34	128.18		
Texas	265,780	2,000,000	7.75	8,210 57	32.37	250.89	681,084,904	330
Kansas	82,080	1,518,552	18 50	8,754.83	9.38	173.46	353,248,582	233
Colorado	103,925	350,000	3.37	4,038.04	25.73	86.67	168,000,000	480
New Mexico	122,580	160,000	1.30	1,321 48	92 76	121.07	43,151,920	270
Southwestern Group	762,320	8,228,552	10.63	31,246.65	24 39	263.33	2,183,437,055	269
Iowa	56,025	1,800,000	32.13	8,304.59	6.70	215.19	505,738,571	281
Minnesota	83,365	1,250,000	14.99	5,375.45	15.51	230.54	577,363,586	462
Nebraska	76,855	1,440,000	18.32	4,979.51	15.41	281.15	176,012,820	126
Dakota	149,100	710,000	4.76	4,465 49	33.40	156.75	161,420,000	240
Wyoming	97,890	85,000	0.87	901 70	108.56	94.36	31,000,000	365
Montana	146,080	130,000	0.92	1,803.73	80.99	72.07	69,000,000	535
Northwestern Group	609,315	5,365,000	8.80	25,830.47	23.53	207.22	1,521,064,977	283
Washington Territory	69,180	309,000	4 47	1,319 02	52.44	226.68	84,671,548	274
Idaho	84,800	100,000	2.60	867.92	97.70	115.22	21,288,392	213
Oregon	96,030	250,000	8.52	1,412.01	68.01	177.05	85,893,429	343
California	158 360	1,350,000	0.55	4,126.19	38.38	327.18	1,107,106,327	820
Nevada	110,700	61,000	0.44	947.73	116.80	64.36	26,758,379	438
Arizona	113,020	50,000	2.48	1,094.84	103.23	45.67	26,313,500	526
Utah	84,970	210,000	1.18	1,153.12	73.69	182.11	46,379,073	221
Pacific Group	717,090	2,330,000	3.25	10,920.82	65.66	213 36	1,398 390,648	600
United States	3,619,050	65,213,107	21.54	156,081,52	19.34	417.81	20,957,668,032	324

NOTE.—There are no taxes levied nor assessments made by the State officers of Delaware or the Commissioner of the District of Columbia. The average valuation per capita for the Middle Atlantic group is, therefore, exclusive of Delaware and the District of Columbia.

A London Water Company; its Remarkable History.

The sale, by auction, July 17, 1889, of a single share in the New River Water Works for the unprecedented sum of £122,800 ($598,650), as noted last week, is made the occasion of review of the remarkable financial history of this company by the *London Standard*, from which we abstract the following facts.

In the early part of JAMES I's reign, water was supplied by two or three conduits in the principal streets, derived from the river and the suburban springs. These conduits were tapped by leaden tubes, which supplied only large buildings. Private residences were supplied by "tankard bearers" or officials, who brought a supply of water each day. This was the state of affairs when an enterprising jeweller, HUGH MYDDLETON, determined to provide the then circumscribed city with an adequate water supply, the water being then both poor and scarce. He proposed to bring the water from Hertfordshire, by a "New River," and began and continued the work until his resources failed, when he applied to the King for assistance to complete the enterprise. JAMES supplied the means, and took for his payment one-half or 36 of the 72 shares into which the stock was divided. The half which remained was called the "Adventurer's Moiety," the quaint name by which these shares are still known The water was let into the city in 1613, or some 276 years ago. At this time the shares were worth £100 each, and the returns from them were meagre, for the project met with all sorts of opposition from the squires, who affirmed that carrying the New river through their estates would cut up the country and soak the arable land, ruin the farmers by floods, and spoil the roads, and also opposition from the conservative Londoners themselves. The water was brought into use very slowly. For 19 years the income was only 12s. per share ($3). In 1634 it was £3 4s.2d. The value of a share in 1836 was £115 10s. In 1800, it was £431 8s. 8d., and in 1820 it had increased to £11,500. In 1878 a fraction of a share was sold at a price which made the whole share worth £91,000. The gross revenue, in 1869, was £268,238,and in 1888, £511,356. The net income for the 36 shares was £98,-960 or £2,610 per share.

The possession of a share in this company, which really pays less than 2½ per cent. on its present value, carries with it several privileges, and its prospective value increases its desirability. The King's shares were sold by CHARLES I to the second Sir HUGH MYDDELTON, the projector having been knighted by JAMES I. on the completion of the works, for the fixed payment of £500 per annum, and this, which is called the "King's Clogg," is still continued. The shares carry with them a reversionary interest for important future accretions. The nominal capital of the company, Dec. 31, 1884, was £3,369,993. The receipts depend upon the annual value of the proper-

ties supplied and not upon the amount of water consumed. The company has the exclusive right of supplying water to all the northern suburbs, including Hampstead and Highgate, the whole of the city of London, a large part of the city of Westminster, wealthy parishes at the West End, and part of Middlesex and Hertfordshire. The estates belonging to this company comprise large tracts of land and important properties in the counties of Middlesex and Hertford, various premises in the city of London, and the Myddleton square estate, which comprises about 50 acres in the very heart of the metropolis, for the most part covered with buildings, the leases of which expire in about 20 years, when the company comes into possession of the rack rents. A bonus is occasionally declared, one in 1874 being at the rate of £1,008 on each share. The possessor of a share is entitled to a seat at the Board. A share, as set forth by the auctioneer, "comprises all the elements desired in the employment of capital—security, regularity, and realizability." It "combines the simplicity of a government annuity, the profits of a trading corporation, and the prestige of landed proprietorship." It carries with it the corporate ownership of the farms and estates, the right to vote both in the city and country, and the qualification for a place on the bench. The share has a clear title for 52 years, and was purchased by Mr. W. I. LANCASTER, Secretary of the Prudential Assurance Company. The New River and "Adventurer's Moiety" still furnish London with an abundant supply of water.

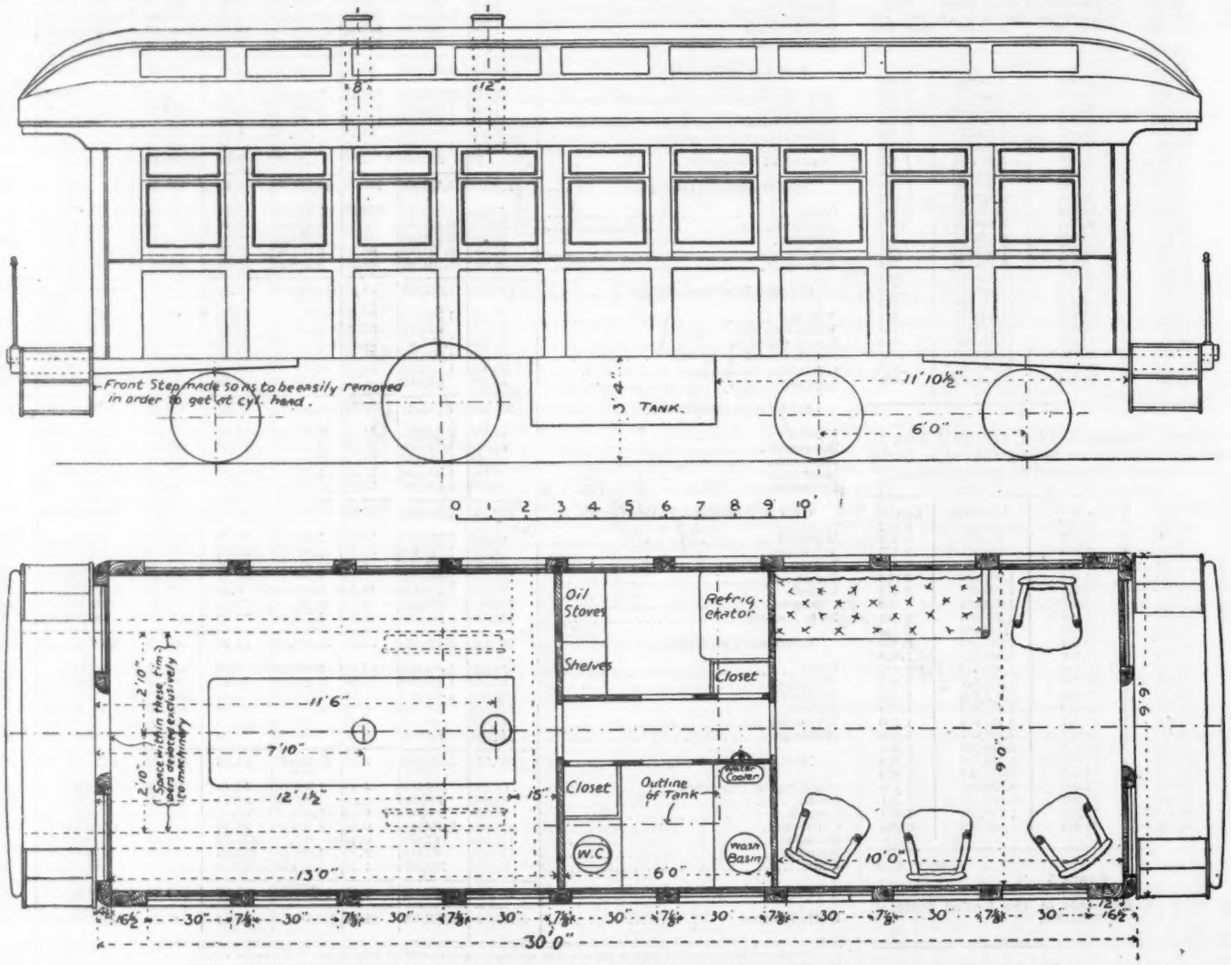
LAKE SUPERIOR GRAPHITE DEPOSITS have been known for the last twenty years as existing in Boraga County, but no attempt has been made until lately to utilize this mineral. The Boraga Graphite Co. is now working a small force in these mines near L'Anse. The vein is several feet thick and of good quality.

Steam Inspection Car.

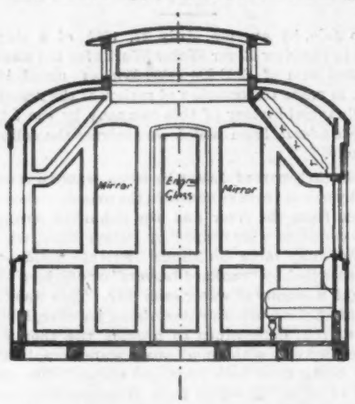
We present herewith plans of a very neat steam inspection car lately designed and built by the Baldwin Locomotive Works, for the use of the Susquehanna Coal Co., combining in itself both engine and car. We shall also give next week a general view of the car from a photograph. While especially intended for rather short trips, it will be seen to contain a fair-sized kitchen in which a moderate amount of cooking can be done, and by the sofa and the two upper berths, it furnishes good sleeping accommodations for three men. Two sofas could, of course, be used, if desired. On many roads of thin traffic, therefore, even of considerable length, it would seem to furnish a very suitable style of officer's or inspection car, while admirably well adapted for short inspection trips. There is often a great waste of time in waiting to attach cars to some regular train, and we imagine that many roads would find such a car economical for maintenance-of-way officers at least.

As the drawings herewith show, the length of the car exclusive of platforms is 30 ft., and its width 9 ft. 9 in. A compartment 13 ft. long contains the locomotive with its machinery. The boiler is of the regular locomotive type, 36 ins. diameter with 100 tubes 4 ft. 4 ins. long: The fire-box is 34 ins. long, 31 ins. wide. The cylinders are 8x12 ins. The driving wheels are 43 ins. diameter, and the weight on driving-wheels about 20,000 lbs. The total weight of the car ready for running is about 52,000 lbs. The engine is fitted with Westinghouse automatic brake, applying to driving wheels and to the wheels of the truck under the passenger end of the car. It is also fitted with Nathan's sight-feed lubricator, and other latest improvements. The tank, which is of 500 galls. capacity, and sufficient for 125-miles run, is hung under the centre of the car body. A coal-box, large enough to contain a supply of coal to run the same distance, is placed in the engine room. This room is finished in light-colored hardwood; it is roomy and comfortable.

Between the engine-room and the passenger compartment are two small rooms. One is fitted with refrigerators, oil stove, china closet, and sink for the use of the culinary department. The other is a toilet room of good size and fitted with all necessary fixtures. The passenger compartment is 9 ft. wide by 10 ft. long inside, and has two upper berths and one double lower berth convertible during the daytime into a sofa. Four movable arm-chairs are also provided. An extension table is provided, large enough for six persons; this folds against the wall, and is of convenient size to use as a writing-table when desired. All the compartments, except the engine-room, are handsomely finished in carved quartered oak, in accordance with the latest designs



Steam Inspection Car "Nydia," Built by the Baldwin Locomotive Works.



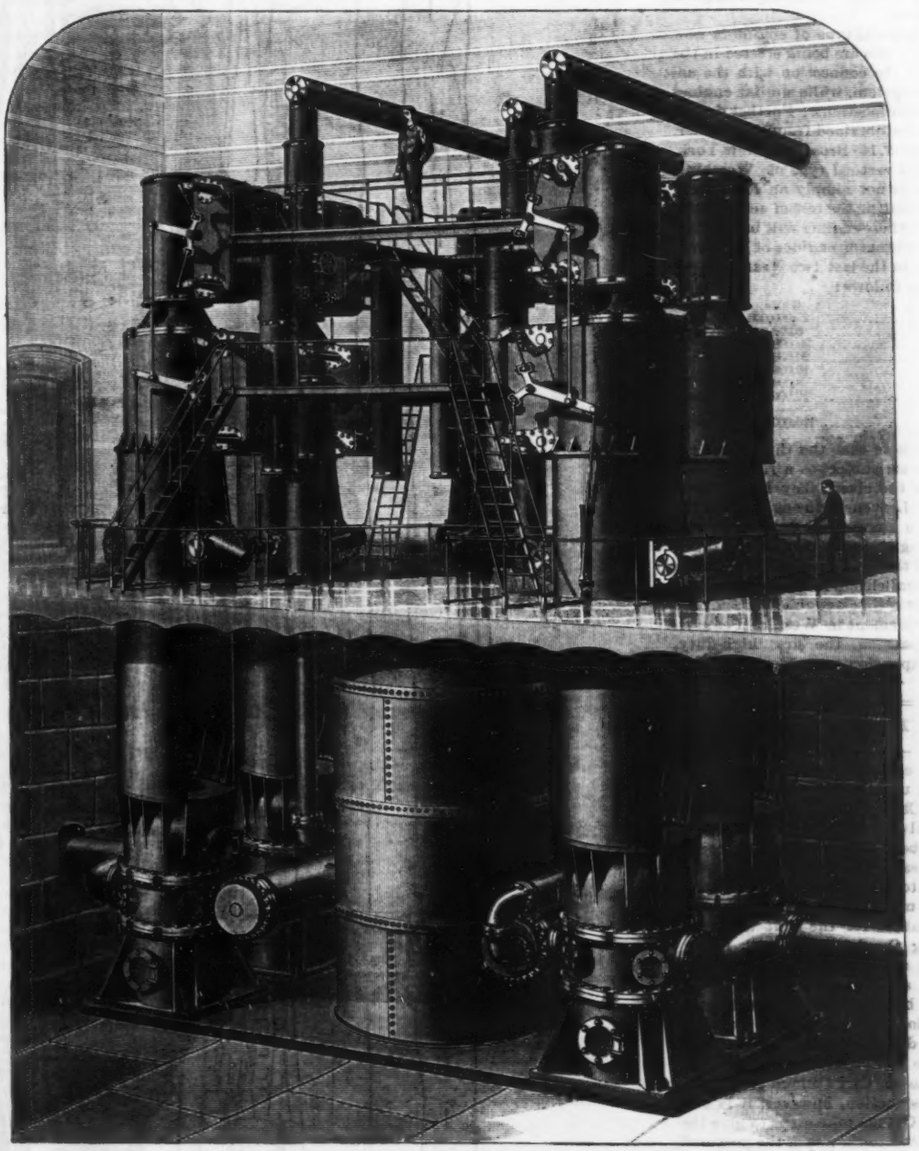
Cross-Section of Steam Inspection Car.

of the Pennsylvania Railroad. The passenger compartment is lighted by a large central lamp. The central windows, one in kitchen and one in toilet room, are arranged to show the name of the car in illuminated letters, to answer in place of the side numbers of the locomotive headlight, so that the car may be readily recognized when passing telegraph stations at night. Two closets open out of the passage-way, one intended for clothing, the other as a storage place for drawings. This car is not intended to run backward, or with the passenger end ahead. When it is necessary to do this for short distances, the engineer can obtain a view of the track by looking out through the side windows, and in addition he can be communicated with by electric signals from the platform at the passenger end of the car. The furnishings of the car throughout are of the handsomest character. The handrails are nickel-plated. The passenger compartment and passage-way are handsomely carpeted. The doorways and upper sash of all the windows are of engraved glass, and all the hardware throughout is of bronze of handsome pattern.

AMERICAN GAS COMPANIES seem now to be attracting the attention of English capitalists, and the gas works of Brooklyn and Philadelphia are both reported as being sought after by syndicates from Great Britain.

The Worthington High Duty Vertical Pumping Engine.

Since the invention of the direct-acting steam pump some 40 years ago, the name of HENRY R. WORTHINGTON has been closely identified with its progress and improvement. The Worthington pump is most generally known as a horizontal engine, whether used for supplying the ordinary requirements of engineers, or in its larger form as used for supplying water for towns and cities; but a vertical type of direct-acting engine, fitted with the high-duty attachment, has lately been designed and built. This is a new departure in the use and arrangement of the Worthington direct-acting pump, and we illustrate this week a triple pair of vertical pumps built for the Artesian Water Co., of Memphis, Tenn.



The Worthington Vertical, Compound, High-Duty Pumping-Engine at Memphis, Tenn.

The peculiar conditions of the supplying of Western cities with water, when the source of supply is from a river whose rise and fall may be anywhere, as in some instances it is, between 10 and 70 ft., renders it desirable, if not important, that the machine be so arranged that the pump shall be placed within easy reach of the water at its lowest stage, while the steam cylinders shall be beyond the reach of its highest floods. To do this requires the excavation of deep well holes, or pump pits, on the banks and near by the river from which the supply is to be taken. Where, as at Memphis, the water will come from artesian wells, it still is necessary to place the pumps within a well or pit. This pit will be 38 ft. in diameter and 45 ft. deep, and within this small space 4 pumping engines will be placed, each of which will have a capacity of 10,000,000 galls. of water in 24 hours, or a total daily capacity of 40,000,000 galls., a quantity of water which it is claimed could not be obtained within such a small pit by an engine of any other than the vertical Worthington type.

For the present there will be, as shown in th cut, only three engines put in operation, but provision is made by which in the near future the group will be made complete by the addition of the fourth one.

The engines are of the compound type, the high-pressure cylinders being 30 ins. bore, the low-pressure cylinders 60 ins. bore, double-acting pump plungers 28 ins. diameter, all having a stroke of 48 ins. These steam cylinders, in addition to the usual attachments of steam inlet, outlet, and cut-off valves, will each have the recently invented high-duty attachment, which just now is of so much interest to engineers by reason of its novelty, simplicity, and the economical results being produced by

its attachment to this class of direct-acting steam pumps.

An explanation of this attachment, and a full description of tests made on an engine fitted with this mechanism, was given in ENGINEERING NEWS, Nov. 6, 1886. We may, however, say that after careful examination and trial on engines having this attachment and working under exceptional and severe service, made by engineers from abroad, the invention has been introduced in some of the largest and most recently constructed pumping engines in London and other parts of England. The engine used to supply the Paris Exhibition with water is also constructed on this plan, and is in constant service, giving great satisfaction by its work.

The Worthington vertical type of engine is now in use in several cities; two are being erected in the city of Brooklyn, N. Y., in connection with the additional water supply system, while similar engines are being built for other locations. Further details of these engines may be obtained from the builder, HENRY R. WORTHINGTON, 145 Broadway, New York.

As showing that this vertical type of Worthington pumping engine is not simply an idea, fully worked up but still awaiting the test of actual duty, the following notes on these engines will be interesting to engineers. Worthington engines of this vertical design have been, in the last two years, erected and put into service as follows:

	Gals.	
Cincinnati, O	25,000,000	low duty
Leavenworth, Kan	6,000,000	high duty
Memphis, Tenn	30,000,000	do
Brooklyn, N. Y	20,000,000	do
Nashville, Tenn	10,000,000	do
Turtle Creek, Pa	5,000,000	do
St. Clair tunnel	19,000,000	low duty
Total	110,000,000	in 24 hrs.

It is interesting to note that the Cincinnati engines in the above list are subject to a rise and fall of 70 ft. in the level of the river: they have differential plungers. The Leavenworth engine from the first start exceeded the guaranteed duty in its regular work, and the engine-house record was taken as an official trial and the plant accepted thereon,—a case, we believe, unparalleled in the history of pumping engines. The Turtle Creek engine, built for the new Westinghouse settlement in Western Pennsylvania, is a triple expansion, the first high-duty, direct-acting, triple-expansion pumping engine ever built.

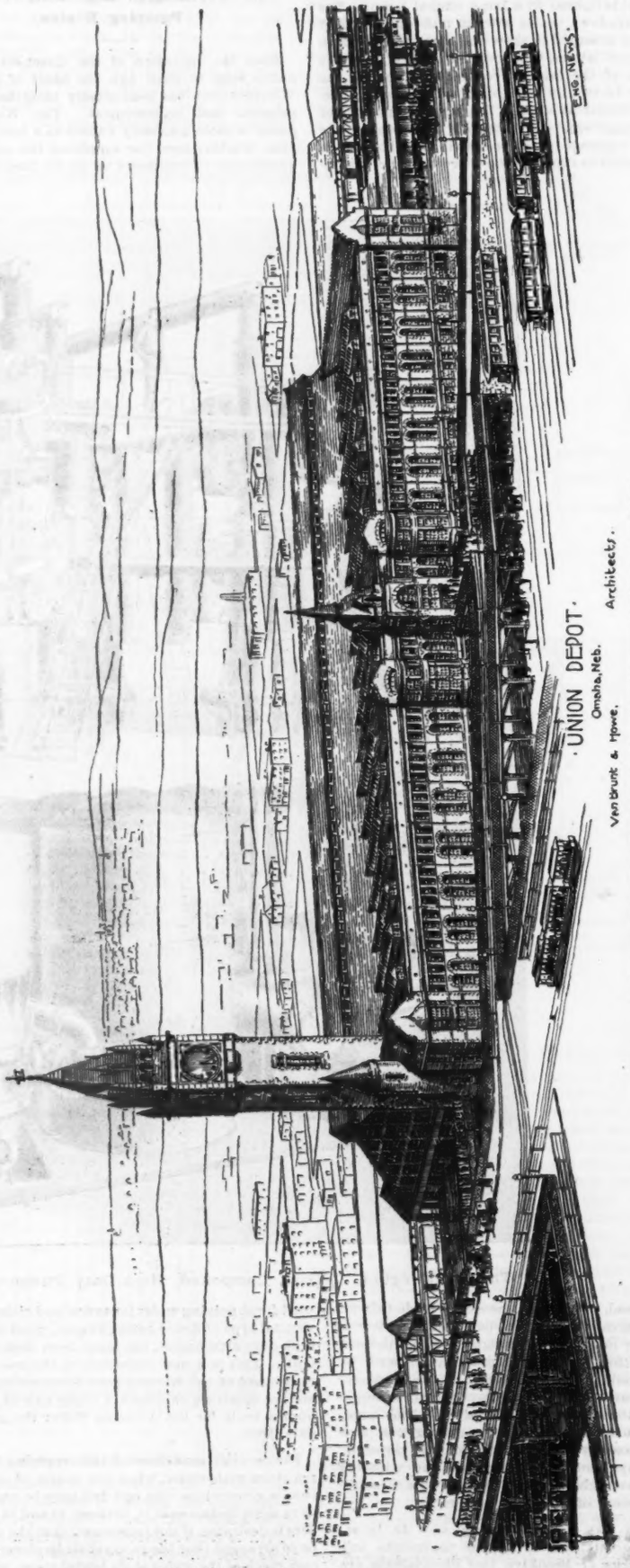
Proposed Union Depot at Omaha, Neb.

The accompanying engraving gives a bird's-eye view of the proposed union depot to be erected at Omaha, Neb., by the Chicago, Burlington & Quincy and Union Pacific railway companies. The need of such a structure has been long felt, and it becomes more pressing each year. On May 2, 1889, the two companies entered into a contract with each other for the formation of a union depot company to build a union passenger station for the joint use of all the railways entering Omaha or Council Bluffs, comprising the lines now operated by 7 different companies. It was also agreed that the tracts of land now held by the Chicago, Burlington & Quincy and the Union Pacific should be conveyed to the proposed union depot company.

The companies have now presented a full statement of their plans to the City Council of Omaha. Before beginning construction, however, it is necessary that the city of Omaha take steps to give the Union Pacific a clear title to the site of the proposed structure. The ground is now held by the Union Pacific by virtue of a grant from the city of Omaha, made 20 years ago, under which the land reverts to the city of Omaha whenever the Union Pacific company ceases to hold and use it for its own purposes. It is also asked that the city of Omaha contribute $150,000, which is expected to cover the cost of the necessary viaduct by which Tenth St. will be elevated above the tracks. The delay necessary to conclude the negotiations concerning these matters between the city and the railway companies interested will probably put off the commencement of construction for some time.

The following description of the proposed structure was prepared by Messrs. Van Brunt & Howe, the architects:

The complication of tracks, grades, and approaches at the railroad center of Omaha is so great that the problem of locating and erecting there a union passenger



Proposed Union Depot at Omaha, Neb. VAN BRUNT & HOWE, *Architects.*

station, in the best position and most convenient form, is beset with serious difficulties.

The scheme, as developed, involves first, the retention of the present train house, 124 ft. x 300 ft., which structurally is in good condition; second, the extension of it eastward by the addition of six bays, thus making the total length 468 ft.; third, the closing in of the openings of the train house at the ends by an architectural screen of glass and iron; fourth, the building of a lean-to along the whole north side, opening into it by a series of arches, thus increasing the total width of the train house by 40 ft., accommodating two or more tracks, and making the present north front presentable with new construction; and, finally, the construction of a new main building along the south side of the extended train house, 54 ft. wide and 468 ft. long, and 3 stories high.

In this main building the express offices, the baggage department, and the emigrant waiting rooms are amply accommodated in the basement, on the track level, where, also, are placed the depot master, the post office department, the Pullman and train supply rooms, and other offices immediately connected with the handling of the trains and the management of the station; in the first or principal story are assembled the great central waiting hall, 40 ft. x 160 ft., with the ticket, Pullman, and telegraph offices, news and check stands, and other conveniences of travel, the separate waiting rooms for men and women, with toilet rooms connected, the barber shop the dining room and restaurants, with their dependencies, and some of the railroad offices which require to be near the public; and in the second story are groups of offices for the several companies using the station, all abundantly supplied with light, air, and sanitary accommodations, and of size and number sufficiently ample to meet the present and prospective requirements of railroad service.

The most important point of convenience to be provided for in such a building as this, thronged as it will be with arriving and departing crowds, is such an arrangement of plan that the human tides in both directions shall not conflict, and that the means of entrance and exit to and from the building for incoming and outgoing passengers shall be made so evident that the possibility of mistake or misdirection shall be reduced to a minimum. To this end, from the Tenth St. viaduct, which should be 100 ft. wide and 25 ft. high over the whole system of tracks, a foot bridge 72 ft. long and 21 ft. wide is thrown across to an archway entrance in a clock tower, which forms the leading feature at the west end of the building. From this archway a broad flight of steps leads downward under the tower to the first or main story, connecting there, through a vestibule and longitudinal corridor, with the system of public waiting halls and offices, and from this landing still further downward to the platform of the train house, on a level with the basement, for the accommodation of passengers leaving the station after arrival by train.

The same bridge communicates with a round barbican tower containing a subordinate staircase for the use of the business offices on the three floors. Direct outside approach for foot passengers and carriages to the central hall is also obtained by another and much more important bridge, or inclined way, 45 ft. wide, leading by easy slope to a platform opposite the middle of the south facade; a bridge is thrown over the intervening traffic way to the great central southern entrance on the first story. From this platform this inclined viaduct descends farther to the track level to accommodate the baggage, express, and hack service in this traffic way or street, which is 40 ft. wide, extends the whole length of the south facade and connects with the baggage and express, delivery, and reception doors in the basement.

From the central hall interior communication with the track platforms is obtained by a grand double stone staircase, lighted from above, and descending behind an arcade in the center of the south wall of the train house to a vestibule which opens through archways to the trains on one side and on the other to the checking counter of the baggage department.

Five tracks are carried through the main train house and two through the northern annex. The platform of the main train house is 34 ft. wide. From its west end arises the before mentioned stone stairs to the tower entrance and bridge. From the middle ascend the broad steps to the central hall, and near the east end convenient stairs invite to the lunch counter and dining room in the first story. In this way whatever inconveniences may be attributed to having the principal passenger accommodations on a story above the track platform are, it is hoped, in a great measure obviated, if not entirely removed.

It will be perceived that as an architectural composition the present train house is entirely enveloped in new construction, and that the new main building, with its great lateral extent, its towers at the west end, its bridges and bays, all constructed on a large and permanent scale, give opportunity for effect rarely equalled in railroad work. It is proposed to construct these new buildings in face brick, with red sandstone dressings, the basement being entirely of stone.

The inclined viaduct will enable the cable system of street cars to connect with all the main entrances of the station. The platforms, where they extend east and west outside of the train house, will be covered by sheds.

The main architectural difficulty occurs in placing a building so large and important on a level 25 ft. below the nearest street viaducts. This has necessitated emphasizing the west facade towards Tenth St. by grouping two towers at this point, one of which is of such considerable height (300 ft.) as to be conspicuous from all parts of the city. A further attempt has also been made to render that part of the architecture which is seen from the highest neighboring levels of street approach as complete as possible in itself, in order to avoid the sunken effect in the building.

Chief Engineer BOGUE'S estimates of the cost of the structure are as follows:

A. The building will cost in fresh outlay $325,000. The inclined roadways from Tenth St. viaducts to Seventh St. platforms, paving, grading, sewerage, tracks, land, Tenth St. viaduct, superintendence, etc., will consume enough more money to make the total cash outlay about $700,000.

B. Certain other improvements are under consideration, but cannot be fully decided upon at present, although they will probably be ultimately required, viz: Interlocking apparatus and signals, additional ballasting, lawn and fountain near Seventh St. bridge, enclosing grounds, train sheds outside of train house, and annex building for heating and lighting plant, all of a probable total cost of $75,793.

C. Existing property that will be used by the depot company consists of: Union Pacific land, Burlington & Missouri land, materials in portions of existing tracks, train house and proportion of Seventh St. bridge, of a total estimated value of $471,694.

D. Recapitulating, we have,

Items under *A*, say	$700,000
Items under *B*, say	75,793
Items under *C*, say	471,694
Total	$1,247,487

E. The above does not include the value of land and plant that will be required by the several companies for storage and care of passenger equipment. Allowing however, that some of the roads may retain their existing facilities of this nature, it is probable that the new expenditure required on this account, together with the value of land used, will make the total value of union depot property, viaducts, and equipment facilities, at least $1,500,000.

A REPORT ON THE SAN DIEGO SEWERAGE SYSTEM, by Engineer of Public Works J. T. SCHUYLER, shows serious difficulties with the system. A new outfall sewer is required, and the mains are alleged to be generally proving too small. It is sewered on the Waring system.

Elements of Weather in the United States of most interest to Engineers, for the month of July, 1889.

STATIONS.	Temperature. Degrees Fah.				Wind velocity. Mil s per hour.			Precipitation. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average.	Max.	Direction at time of Max. Vel.	Total.	Heaviest in 24 hours.	No. rainy days
Northern Cities.										
Northfield, Vt.	66.1	74	56	18	7.5	30	N	4.65	1.40	17
Portland, Me.	66.4	80	52	28	7.5	33	S	3.10	1.30	13
New York City	72.7	88	60	28	7.6	35	SW	9.63	2.68	16
Pittsburg, Pa.	74.6	93	56	37	3.9	28	S	5.48	1.45	13
Chicago, Ill.	70.5	90	54	36	8.0	36	SW	9.56	4.02	12
Omaha, Neb.	73.4	94	56	38	7.2	36	W	4.94	1.87	12
St. Paul, Minn.	71.2	96	52	44	6.1	28	SE	3.08	2.10	12
Duluth, Minn.	64.0	84	50	34	6.3	30	NW	5.53	1.95	11
Bismarck, Dak.	68.8	95	48	47	8.9	36	S	2.01	0.69	13
Average	69.7	88.2	53.8	34.4	7.0	32.2		5.33	1.95	13.2
Southern Cities.										
Washington City	76.0	92	59	33	6.0	26	NW	8.13	3.18	15
Louisville, Ky.	76.4	92	59	33	4.2	31	SW	2.98	0.98	16
St. Louis, Mo.	77.8	93	61	32	6.8	34	W	2.02	0.45	12
Savannah, Ga.	81.0	95	70	25	7.0	24	SW	6.21	2.59	15
Leavenworth, Kan.	75.5	93	56	37	5.4	30	NW	3.02	0.70	11
Jacksonville, Fla.	81.9	97	70	27	7.2	28	S	7.50	1.46	15
Chattanooga, Tenn.	78.4	92	63	29	4.7	25	N	3.33	0.87	14
New Orleans, La.	82.6	95	71	24	6.0	32	SW	9.13	2.04	21
Memphis, Tenn.	80.5	94	64	30	5.2	37	W	4.77	1.57	19
Palestine, Tex.	81.8	99	70	29	4.7	23	SE	2.21	0.64	9
Average	79.2	94.2	64.3	29.9	5.7	28.0		4.93	1.45	14.7
Western Cities.										
Helena, Mont.	66.9	91	39	52	5.4	32	SW	0.34	0.15	7
Port Angeles, Wash.	55.8	83	41	42	5.6	24	W	0.00	0.00	0
San Francisco, Cal.	58.8	83	50	33	12.2	36	SW	0.01	0.01	0
Salt Lake City, Utah	79.2	102	52	50	6.5	34	SW	0.08	0.04	2
Denver, Col.	72.1	100	50	50	6.1	32	SW	2.94	1.18	12
Yuma, Ariz.	92.0	117	67	50	8.1	38	S	T	T	0
Santa Fé, N. Mex.	69.4	90	52	38	6.6	31	N	1.32	0.55	15
Average	70.6	95.1	50.1	45.0	7.2	32.4		0.67	0.28	5.1

The Johnstown Flood,—Effect on the Engines at Conemaugh.

By courtesy of Mr. J. T. RICHARDS, Asst. Chief Engineer of the Pennsylvania Railroad, we are enabled to present herewith, in the accompanying cut, a precise record from surveys of the marvellous way in which the 32 locomotives in and about the Conemaugh round-house were tossed about like corks by the furious current of water. Our engraving is reduced photographically from a plat on a scale of 100 ft. per inch, constructed from actual survey.

A more appalling and almost incredible exhibit of the power of water in rapid motion was probably never made than just at this point. It had to be seen to be appreciated, but we do our best to make it clear in connection with the accompanying engraving.

The engines were mostly of the very heavy Consolidation type, Class I and Class R, Conemaugh being at the foot of the mountain grade; but some of them were of lighter types. The Class I engines weigh 79,400 lbs. on drivers, 12,240 lbs. on truck, total 91,640 lbs. The Class R engines weigh 100,600 lbs. on drivers, 14,025 lbs. on truck, total 114,625 lbs. The tenders weigh about 23,000 lbs. empty, and carry about 33,000 lbs. when loaded.

These tenders were almost universally stripped away from the engines, and carried far away down stream, a large number of them having stopped only in the jam at the Johnstown bridge, three miles below. The remainder were strewn along the banks down the valley, some with and some without some fragments of trucks under them. One of these tenders chanced to be carried, side up, against a large tree well out toward the edge of the torrent. It was broken through the middle and whipped around the tree in an instant and remained there, high above the ground, when the writer visited the valley three days later. All the tenders which remained attached to their engines or in their vicinity are indicated on our engraving, and it will be observed that there are only two of them, 477 and 1141. The remaining 30 tenders were every one of them swept down stream further than the limits of our map, which shows continuously a stretch of half a mile below the round-house, and including the break, shows nearly a mile.

A tender is a tolerably heavy body to be thus tossed about by running water, but a locomotive is so much more unlikely a body for such experience that the fate of the tenders is of comparatively minor interest. We may add that the round-house was capable of accommodating 16 engines only, and that consequently some of these engines were standing about the yard in various positions, some above and some below the round-house, precisely where, it is now forever too late to indicate. Locomotives 76 and 1094, however, were at the head of trains of cars which went through the flood without serious injury, the intermediate tracks being likewise filled with cars in a nearly solid mass. It is therefore probable that most of the engines were well up toward where the round-house once stood, as shown on the plan.

Every vestige of this round-house and connected buildings, wall, foundations, turn-tables, turn-table pit and all, was swept away as completely as if they had never been. The only relic of what had been the round-house and shop was a part of the brick walls of the ash-pit. The turn-table girders were carried a long distance away; precisely how far we did not take the trouble to observe. The locomotives were moved about as follows, measuring for each from the centre of the round-house:

Locomotive No.	Carried down Stream. Ft.
691	4,844
1,300	4,660
655	2,350
192	2,285
1,294	2,265
976	2,190
1,197	1,220
416	1,200
437	1,139
342	990
250	970
295	945
1,123	920
744	870
655 } 220 }	850
1,055 } 477 }	810
1,141 } 1,019 }	720
780	610
880	480
23 engines.	average ft. 1,347

The remaining 9 engines were moved various distances, as shown, but hardly one of them less than 100 ft. Consolidation Locomotive 9, Class I, was, by a curious freak of the flood, thrown out almost to the very edge of it, at the foot of the slope.

The average for the 23 engines given is 1,347 ft. Neglecting the first two, which we cannot be certain did not stand at the lower end of the yard, the average is 1,025 ft. or nearly a quarter of a mile, and this in a river bed filled with large boulders, tender trucks, etc., against some of which the engines usually lodged and (if not carried off again), were instantly buried beneath rocks and stones, so that, when we visited the scene after the flood, many of the locomotives so marvellously tossed about were completely buried, and few of them had more than their upper parts above the surface of the river bed.

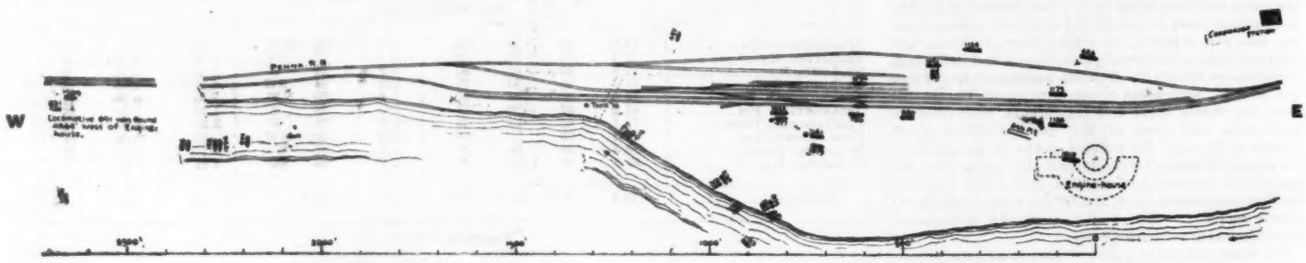
This will seem less incredible by examining our map and noting in what frequent instances one locomotive served to stop another; as, for instance, the group 744, 655, and 220; 655, 192, 1294, and 976; 1197 and 416; 1055 and 477; 1141 and 1019.

The two last-named engines were curiously interlocked, and the battered number-plate of 1019, which was removed in the presence of the writer, was presented to this journal as a relic of the flood. It now ornaments the walls of this office, where it may be inspected by the curious, and where it affords one of the most curious of the minor evidences of the force of the torrent, in this respect. The number-plate is of cast brass, 16½ ins. in diameter, weighing 19½ lbs., and was formerly supported on three 1-in. studs, 4½ ins. long, arranged in an equilateral triangle of 11½ ins., and cast with it. The plate varies from ¼ to ⅝ in. in thickness. The locomotive, as it finally rested, headed down stream, but it is evident that it originally headed up stream, and the force of the torrent was such that it forced the flat plate almost evenly back, forcing the studs to project through it, and so forming three distinct projections in the surface of the plate, nearly an inch high and but little over 2 ins. in diameter at the base. It was evidently the pressure of water only which did this, because, had it been stones or other solid bodies, the whole plate would have been distorted, which is not the case.

If there be a more curious relic of the flood than this, we do not know of it. It only remains to add that the general situation of Conemaugh with reference to the rest of the valley can be seen by reference to the map in our issue of June 15; and to add that our account of the course of the flood given in that article was incorrect in two important respects.

It will be seen by referring to the map that there were two very exaggerated cases of horse-shoe bends in the valley, one just above the high viaduct which was so completely washed away, and which was replaced by a temporary structure built under direction of Superintendent of Motive Power T. N. ELY, in the marvelously short period of six days, without access to any other timber than such as could be cut in adjacent forests; and the second below Mineral Point, in the point pierced by the old Allegheny Portage tunnel, illustrated in our issue of June 22. In both of these cases, there was a railroad cut across the neck, and in both cases *the bulk of the flood water went directly through these cuts*, and not around the bend, although the grade of the upper one was about 70 ft. and of the lower one about half that above the usual water level of the stream.

With this we complete our description of the Johnstown floods, but we may add that we have two or three letters relating to details of it still on hand for publication, for which we have not yet been able to find room. We may add further that Mr. RICHARDS' blue print shows the engine numbered 780 on our drawing without number, and shows the engine numbered 1019 (of which we now have the number-plate) as No. 780. Having assisted in the removal of this number-plate, and there being no other engine in the vicinity with which it could possibly become confused, we have the best of all grounds for disputing and correcting the record, especially as the number 1019 does not appear on the record at all, a fact not wholly disconnected, doubtless, with the circumstance that very shortly after the disaster, before the survey was made, the number-plate of 1019 was on its way to this office by express, and there was no other positive method of identifying the engines. With some partial exceptions, all the engines were so badly battered by the flood as to be worthless for anything but scrap.



The Johnstown Flood; Location of the Locomotives swept away from the Conemaugh Round-House.

One Locomotive (No. 9) is not shown on Cut. It lay about 440 ft. south of Locomotive No. 880.

The Work of Rotary Snow Plows.

The following valuable report by Mr. R. MARPOLE, Superintendent of the Pacific Division of the Canadian Pacific Railway on the work of the rotary plows in the Rocky Mountains, is about as practical an exhibit of the actual capacities of such plows as could well be made, since the conditions there are very severe. The report only refers to the Leslie plow, which was then the only one extant, but the new Jull "gimlet-pointed" plow is also to be tried there in the coming winter.

Respecting the merits of the Leslie Rotary Snow Plow, which was sent to this division last fall for operation on the Selkirk section, I beg to report as follows:

The first test we made was at the summit, in November, on the summer track, in snow averaging 2½ ft. deep, which was very much saturated with the rain that was then falling heavily. At a speed of 4 miles per hour, 2,000 ft. of track was cleared without trouble, except at a point where a bank of snow, very wet and packed, over 3 ft. in depth, was struck. The machine making about all the revolutions we could get out of it, and the speed of trains increased to double former speed, the discharge got choked up, and had to be shovelled out before we could get the wheel to revolve, although we attempted, by reversing, to avoid it.

A second trial at the former speed of 4 miles per hour and machine run at full speed, was successful, and no trouble with choking was experienced.

Our next test was with compact slope snow in through cut shovelled into centre of track to a height of 6 ft. and for a distance of 600 ft. This material was, as may be understood, very hard and compact, being the snow lifted off the centre of track by nose of wing-plow, and pushed back to sides, clear of car, by wings of plow. We attempted first to crowd the machine, so to speak, to a speed of 10 miles per hour, to test its capacity, as claimed by its inventor and by published reports; but although we got the greatest number of revolutions possible out of the machine, it again choked itself, and, in the expressive language of a foreman, "bit off more than it could spit out," which gives the whole truth in a nutshell. By reducing the speed to 5 miles per hour, no trouble whatever was experienced, and the machine did effective work. Hereafter the machine was in service at this class of work, and the result was always of the same encouraging character.

In December and January, we had several fair tests of the plow in dry snow, and I am free to confess that it fully fulfilled the claims of the patentee in respect to speed and effectiveness in this class of snow. In level fall or drifted dry snow, it can be run at a speed of 15 miles per hour, as from close observation I do not think it is possible to choke it with this class of snow.

The machine has a tendency to throw a small amount of snow out at the front to each side, but an extension of the scoop would obviate this. We cannot take advantage of this, however, in the mountains, as with wet, compact snow, and snow slides, our object is to get the cutting knives into contact with the snow as quickly as possible.

Last season, 1887-88, without the rotary plow, as you are aware, we were compelled to remove snow from congested through and side-hill cuttings by means of trains and a great number of shovelers, and our difficulties were much enhanced by the fact

that dumping ground for such stuff was scarce between Bear Creek and the Loop, as, after several small structures were filled up, we were compelled to run our work trains longer distances, entailing great loss of time and constant trouble in backing up over badly flanged track, occasioned by the almost continous snow-fall and drifts in that neighborhood. By the use of a few shovelers and the rotary snow plow, all these difficulties are avoided. By shoveling, in fact, dragging the compressed slope snow on to the track to a width covered by the scoop of the rotary and the wings of the same, the material is thrown far and clear of track, and at the same time a first-class flange is left. In heavy level snow-falls of over 12 ins., we run the rotary. In snow-falls of less than that, we run the ordinary wing-plow, as speed is the desideratum, and the cost, of course, is far less.

In February, we were afforded a chance to test the rotary in a snow slide, but it was not of as great a magnitude or cohesiveness as the majority of the great avalanches over sheds. The slide in question, descended between Nos. 19 and 20 sheds, and came from a point about 2,000 ft. above the track, and was entirely free from timber, ice, and rock. It was 300 ft. in length and 32 in greatest depth over track, was of course very compact, and would in my opinion weigh about 30 lbs. per cu. ft., about half the weight of ice. We tackled this slide with the rotary and two heavy engines, one Mogul and a Consolidation, on a 2 per cent. grade, working down hill. The first 25 ft. or so (greatest depth 8 ft.) was cleaned out without trouble. After this, the two engines could not propel the shovel into the compact material without backing up and punching at it, the invariable result being that the machine choked itself so completely that shovels even failed to dislodge the really cemented material, and we were compelled to free it by the use of a steam hose connected with the engine of rotary. I put on another Consolidation engine, and ordered a steady pressure to be maintained against the face of the snow; but as the depth of the slide was more than the height of the rotary, we had of course to break and shovel the material forward into the cut already made by the shovel. By continued and steady onslaughts in this manner, we cleared the the whole slide out in 5 hours from the time of commencement, having only 18 men.

Without the rotary, and with flat cars and all the men we could have worked covering its surface, it would have taken at least 12 hours to clear out this slide, so that from every standpoint the test was satisfactory. Undoubtedly, had this slide contained much timber, the delay would have been greater, but the number of men employed would have been about the same.

The principal trouble, as you will perceive, was in getting the knives into steady contact with the face of the slide, the obstruction being the cutting edges (bottom and sides) of the scoop, which you are aware project 18 ins. in advance of the knives. We cannot overcome this difficulty without special devices, and we are now figuring in this direction. The extended scoop has to be retained for ordinary work in level fall and slope slides. We subsequently cleaned out other smaller slides in a satisfactory manner.

I return Mr. PETRI's letter to the President herewith, regarding the cost of working the plow. The crew ordinarily consists of an engineer and fireman, who attend exclusively to the motive power, and one foreman and two assistants in charge of the plow proper, the foreman handling the signals for excavator, ice cutters, and flangers. Running the machine continuously all day would consume as much coal as an ordinary locomotive, 3 or 4 tons.

My report, as given, fully answers Mr. PETRI's interrogatory as to the merits of the respective plows, rotary or common wing-plows. Briefly, it is this: In ordinary snow-fall, light drifts of under 2 ft., the common wing-plow will answer all practical purposes, until the cuttings become choked or congested, in which case, and in heavy snow-fall, heavy drifts, and particularly in slope slides, the rotary plow is the only effective device to my knowledge for coping with such difficulties. The temperature has considerable to do with determining the machine to be used as occasion demands, the rotary always having the preference.

As you are aware, we made several changes in the fittings of our rotary on arrival here; these did not affect the working parts, but gave extra means for viewing track ahead, access to roof of machine, disconnecting ice cutters from machinery that simultaneously operated flangers so that the former could be worked at will independently of the latter, as is frequently required.

We applied the Westinghouse air brake, and if we can do so will raise the roof of machine over the engine to give more headroom for the engineer, as it is difficult for him to handle reverse lever in the present cramped quarters.

THE CHICAGO, BURLINGTON & NORTHERN had a strange defence set up for it in the following story recently sent over the wires from Boston:

The Burlington & Northern people are not disposed to accept the blame of all the rate troubles in the Northwest. . . . When the railroad people condemn its course, they forget that the St. Paul road, when it built down to Kansas City, and thereby tapped some of the best business of the Chicago, Burlington & Quincy, simply invited an encroachment upon its own territory. But for the fact that the St. Paul had built a line to Kansas City, the Burlington & Northern would never have been constructed. The Chicago, Burlington & Quincy people were forced to this course in retaliation for the St. Paul's action.

That is to say, the noble motive of revenge was the cause for the construction of the Burlington & Northern! The inventor of this weak defence of the action of the Burlington managers evidently relied on the fact that most people have short memories. A glance at Map No. 11 of our series, giving the construction for the past three years, shows that the Chicago, Burlington & Northern was built in 1885 and 1886, while the extension of the Chicago, Milwaukee & St. Paul system to Kansas City was built in 1886 and 1887. Neither extension is at present the subject of great pride on the part of its projectors and builders; but each party should bear their own share of blame and not try to shirk off part onto their rivals.

PERSONAL.

President EVARESTE CARAZO, of Nicaragua, died Aug. 1, and has been succeeded by Dr. SARCASA.

Mr. E. E. HUGHES has been appointed Assistant Superintendent of the Chicago & Northwestern's Middle Iowa division, vice Mr. H. C. MANHANUA, resigned.

Mr. E. J. WHITINGTON has been appointed Division Master Mechanic of the Chicago & Alton Railway.

City Engineer A. R. DOW, of Burlington, Vt., has gone to St. Johnsbury to superintend the laying of the new sewer system.

Mr. J. STERLING DEANS, M. Am. Soc. C. E., for several years Assistant Engineer of the Phœnix Bridge Co., of Philadelphia, has been given charge of all the outside engineering work of the company, including the erection.

Mr. T. W. MCCORMICK, of Brunswick, Ga., has has been appointed Superintendent of the Tuscaloosa, Ala., water-works, vice Mr. W. T. TODD, resigned.

Mr. C. A. KENASTON, of the Geological Survey, has been appointed a special commissioner, by Secretary of the Interior NOBLE, to visit France for the purpose of studying the irrigation systems of that country, with a view to the improvement of our own.

Gen. JAMES C. DUANE, U. S. A., retired, hopes to have his eligibility as an Aqueduct Commissioner argued before the Supreme Court in October next.

Mr. ANDREW BRYSON, M. Am. Soc., C. E., has been appointed Chief Engineer of the South Brooklyn, R. R. Terminal Co., of Brooklyn, N. Y.

Mr. E. K. MORSE, of the firm of Ryland & Morse, has returned to this country from Australia, having finished the erection of the Hawkesbury bridge. The work has gone on throughout, smoothly and rapidly, and reflects much credit on the firm.

Mr. WM. M. GRAFTON has been appointed Signal Engineer of the Pennsylvania lines west of Pittsburg, with office at Pittsburg. This is a new office, rendered necessary by the immensity of the Pennsylvania lines and the increasing business.

Mr. T. B. SERGEANT has been appointed General Superintendent of the American Midland Railway, with headquarters at Findlay, O. Mr. SERGEANT went to the Midland from the Wabash, where he was an Assistant Superintendent, but was formerly with the Michigan Central in a like capacity.

Mr. RICHARD WINLACK, of Middleport, Pa., is reported to have been shot from ambush, and instantly killed, on Aug. 2, while surveying land in Randolph county, W. Va., in company with surveyors and other parties of that county. Mr. WINLACK was an old and widely known citizen of this county, and was engaged in making surveys of coal lands in the interest of prominent capitalists.

Mr. H. R. DILL has been appointed Superintendent of the Richmond & James River division of the Chesapeake & Ohio Railway, vice C. T. DABNEY, resigned. Mr. M. B. CUTLER has been appointed Superintendent of the Huntington division, in place of Mr. H. R. DILL, transferred. Mr. SAMUEL D. MAYER has been appointed Superintendent of the Pennsylvania division and terminals at Richmond and Newport News.

Gen. HENRY DU PONT, head of the famous powder firm of that name, which has supplied most of the government powder since 1800, and is the largest concern of the kind in the world, died Aug. 8, on his birthday, aged 77 years. He was of a distinguished French Huguenot family, his father having emigrated to this country in 1800. He was a graduate of West Point, a prominent officer in the civil war, and a man of immense wealth, his personal estate alone being valued at $15,000,000 while he was the largest landholder in Delaware.

PUBLICATIONS RECEIVED.

—*University of Pennsylvania.* Catalogue and Announcements, 1888-1889.

—*Express Trains, English and Foreign*: A Statistical Account of all the Express Trains of the World. By E. FOXWELLAND and T. C. FARRER. London: Smith, Elder & Co. 8 vo., cloth, pp. 181, 6 maps, many tables, no index. $1.50.

Railroad men will find this an interesting work to read and study. Engineers, and the public generally, would find it more interesting if its meat were boiled down into a tenth of the space. An immense amount of trouble has been taken in compiling it, however, and we shall hope to notice it further at a later day.

—*Catalogue of the Gold Car Heating Co.* New York. 4to., cloth; pp. 72.

A very elaborate and excellent catalogue, showing all the details of their appliances, which we have often described. Their compound coil heaters are, in our judgment, an excellent and thoroughly scientific device.

—*First Annual Report on the Statistics of Railways in the United States to the Interstate Commerce Commission for the year ending June 30, 1888.* HENRY C. ADAMS, Statistician. Pub. Doc. 8vo. pp. 390, good index.

We review this volume editorially in this issue.

—*The Electric Street Railway System at Richmond, Va.* An illustrated pamphlet issued by the Richmond Union Passenger Ry. Co., containing a description and news of the line, which is operated on the Sprague system.

—*Connecticut Association of Engineers and Surveyors.* Proceedings of the association at the meetings on June 5 and Aug. 28, 1888, and annual meeting, Jan. 8, 1889.

The pamphlet contains papers on "Wire Rope," by WM. B. PALMER; "Board of Engineers, for River and Harbor Improvements," by C. H. BUNCE; "Foundations and Piers of the Thames River Bridge at New London, Conn.," by Col. J. A. MONROE; "Iron Buildings and Roofs," by C. M. JARVIS. There is also a report on the classification of masonry, and another on wire rope.

—*Notes on the Theory of Cantilever Bridges.* By CHAS. MCMILLAN, C. E., Professor of Civil Engineering, Princeton College, Princeton, N. J.

A recent notice of this paper in these columns has elicited so many inquiries for it that we wrote Prof. MCMILLAN about the matter of extra copies. We beg leave to announce therefore that the paper was originally published in the June number of Vol. II. No. 2, Selected Papers of the Rensselaer Society of Engineers, Troy, N. Y.: a limited number of copies were afterwards printed for class use by the author, and there are about 30 copies remaining, which can be had at 25 cents each, by addressing Prof. MCMILLAN, at Princeton. The price is nominal as compared with the real value of the pamphlet.

—*History of Education in North Carolina,* by CHARLES LEE SMITH.

—*History of Higher Education in South Carolina, with a Sketch of the Free School System,* by COLYER MERIWETHER.

—*Education in Georgia,* by CHARLES E. JONES.

—*History of Education in Florida,* by GEO. G. BUSH.

—*Higher Education in Wisconsin,* by WM. F. ALLEN, and D. E. SPENCER.

The above are publications Nos. 3 to 7 of the contributions to American Educational History, edited by HERBERT B. ADAMS and published by the Bureau of Education, Washington, D. C.

SOCIETY PROCEEDINGS.

Engineers' Club of Cincinnati. At the 13th regular meeting of the club there were 31 members present, also 2 visitors.

The paper of the evening was by Mr. WARD BALDWIN, on "The Method of Calculating Bridge Strains for a Concentrated Rolling Load," in which he presented a review of a method using a graphical diagram for ascertaining the strains induced in simple girders and trusses by the now almost universally specified rolling load for railway bridges, by which method a considerable saving is made in the calculations required, and the work is much simplified.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

New England Roadmasters' Association.—Annual meeting at Boston, Aug. 21. Secy., W. F. Ellis, Woonsocket, R. I.

American Association for the Advancement of Science.—Annual meeting at Toronto, Canada, Aug. 28. Secretary's office at Salem, Mass.

Civil Engineers' Society of St. Paul, Minn.—Next meeting, Sept. 2. Secy., Geo. L. Wilson, City Hall.

Western Society of Engineers, Chicago, Ill.—Next meeting, Sept. 4. "Compound Lumber," G. A. Ljungstrom. Discussions on "Electric Underground Railways" and "Municipal Engineering in Large Cities." Secy., J. W. Weston, 73 La Salle St.

Association of Civil Engineers, Dallas, Tex.—Next regular meeting, Sept. 6. Secy., E. K. Smoot, Elm and Austin Sts.

Roadmasters' Association of America.—The annual convention will be held at Denver, Col., beginning Sept. 10. Secy., H. W. Reed, Waycross Ga.

Boston Society of Civil Engineers.—Next meeting, Sept. 18. Secy., S. E. Tinkham, City Hall.

In a late interview concerning the laying of the new 48-in main, which is to bring more water into Washington, D. C., from the Georgetown reservoir, Col. GEORGE H. ELLIOT, U. S. Engineers, makes a statement which does no credit to the past generation of District engineers. He says, in substance, that previous to the SHEPHERD government the District authorities kept no record of what was put underground, neither of gas nor of water mains nor of sewers. As a consequence the workmen engaged in burying the new main may strike anything from "a sewer to a graveyard," and be obstructed and delayed accordingly. This is a discreditable record for the capital city of our country; but the discouraging fact is that it does not stand alone in this respect among our older cities. It is little more than ten years ago that a more than usually systematic chief of the water department of Philadelphia, failing to find any office records, had to have trenches cut about one of the city reservoirs to locate the mains and stops controlling the supply. Up to his advent in office a few city employés knew where these pipes and stops were, and by this knowledge held themselves in position indefinitely, as the department possessed no records whatever of its own. The discharge of one too over-confident employé, however, and the digging of a trench around one basin to uncover the pipes speedily, brought the other reservoir superintendents to terms and induced them to put all their knowledge at the department service. But to this day, the earlier sewers and many miles of water pipes are unrecorded in Philadelphia except as they are uncovered in later improvements. The same lack of certain knowledge concerning earlier construction in New York is one of the very serious problems confronting any paper plan for rapid transit tunnelling.

THE conflagration which destroyed the business district of Spokane Falls last week seems to have been due primarily to the considerable number of highly inflammable wooden structures which were scattered among the newer and more solidly built brick and stone structures in the business part of the town, and which served to spread the fire so rapidly that it soon got beyond the fire department's control.

From all the data at hand it would seem that the water supply for fire protection was at least as good as the average in cities of its size. The supply is from Holly water-power pumps with a daily capacity of 10,000,000 galls. There are nine miles of kalamein and cast-iron mains and 84 Holly hydrants. The ordinary pressure is 90 lbs., and the fire pressure as high as 150 lbs. The population is now nearly or quite 16,000.

The Superintendent Mr. R. A. JONES, was away at the time of the fire; and according to the press reports, the men left in charge were incompetent; some of the pumps were not connected with the mains, and the pressure was so small that no efficient streams for fire service could be had. Where the blame lies for such inefficiency we cannot undertake to say; but the lesson taught by the occurrence is one which many waterworks commissioners and superintendents need to learn. Machinery which is to be relied on in an emergency should never be left in charge of any person not equally reliable in an emergency, even though such a man's services are expensive; and both men and machinery should always be ready to respond promptly and do the right thing when the emergency comes.

THE little item about a single share of the London "New River Water-Works" selling for $614,000, which we published lately, was worthy of more than passing notice. There being 72 of such shares, the total market value of the works, at this rate, is $44,608,000. As this is only one of eight companies supplying the city of London, it may be at once seen that either the Londoners use a great deal of water, or that they pay pretty dearly for what they do use, the latter being the real fact. The total income of this company in the year 1887, which is the last report we have at hand, was $2,289,000, while its expenses were only $633,000, leaving $1,656,000 as net income, sufficient to pay interest at 3 per cent. on $55,200,000. That every one of these eight water companies is virtually a most profitable monopoly is evident from the fact that the works are all of a rather cheap character, distributing anything but perfectly pure water, and from the following figures of the income, expenses, and per cent. of operating expenses of the companies; from which it will be seen that their net income now aggregates £1,215,115, or over $6,000,000, sufficient to pay 3 per cent. on $200,000,000, while their nominal capital is only $53,000,000, and the actual cost of the works very much less.

	Income	Expenses	P. c. exp.
Chelsea	$123,263	$30,879	25.0
East London	251,158	84,553	33.7
Grand Junction	173,145	49,034	28.3
Kent	118,591	28,159	23.7
Lambeth	200,918	58,579	29.2
New River	457,689	126,627	27.7
Southw'k & V'x'h'l.	191,986	71,365	37.2
W. Middlesex	209,520	61,959	29.5
Total	$1,726,270	$511,155	29.6

We can imagine what a howl would be raised in any of our large cities if a few individuals were salting away such large profits as these from such a scant supply of inferior water, with fully two-thirds of the houses having only an intermittent supply of any kind—and we need not feel quite so ashamed as we otherwise ought to of our American street pavements and other beauties of civic administration.

THE new list of members of the American Society of Civil Engineers contains an abstract of all the provisions of the laws of the State of New York having a bearing on the organization of that Society, evidently called out by the recent circular of the Cincinnati Association of the Am. Soc. C. E., which effectually puts a quietus on the absurd doubts of its being legally possible to organize that society in any other manner than by having a majority of its managing officers resident in the city of New York, or at least in the State. This argument has been frequently advanced, and by officers of the Society who ought to know, and there were some passages in the laws in force years ago that did seem to require it; but since 1883 all that has been reqired has been that a majority of the "five or more persons, citizens of the United States," who *originally incorporate* such an organization shall be resident within the State, and nothing is said about the residence of the officers or of subsequent accessions to membership

Neither has it ever been necessary that a majority of the Board of Direction should be present to have its actions legal. Power is given to make any quorum by the by-laws of the Society, save that the presence of two-thirds of the Board is very properly required to legalize the purchase, lease, or sale of real estate. There is therefore no legal obstacle whatever to any alterations of the constitution of the Society which may be judged expedient, in the line of recent suggestions.

A CANADIAN correspondent writes us: "I take advantage of being a subscriber to ENGINEERING NEWS to trouble you for a little information about Mexico. I have had some three or four years' varied experience on top of an engineering education, and, having just lost my position by a reduction of staff, I am thinking of going to Mexico to see how I can prosper there. Could you tell me, in the light of your experience of that country, if a person striking down either to the Mexican border or into Mexico itself, without any previous arrangements, would be likely to find anything (preferably something more permanent than engineering) that would keep him going? Living, I have heard, is exceedingly expensive down there, and I could not afford to pay my own way many months while waiting for something to turn up."

More than one of our readers may be afflicted with a like restlessness, for it seems to be a common weakness to believe that, although there is no gold for us in the rainbow, where we are, away off at the end of it somewhere there is a pot of gold to be had for the

picking up. To all such restless spirits it seems worth while to give a word of caution. Their best chance in life by far is at home. There is but one country to which a Canadian can emigrate with any rational hope of bettering his condition, if he can ever do it by a "still hunt" emigration, and that is to the United States; because there is no other country, known to us, in which the road of a young man to reasonable success is easier than it is in Canada. In no country is the road an easy one; but how can a man possibly expect to go to comparatively unprogressive and poor countries, where the people and the language and the customs are all strange to him, and where there is certainly no lack of idle people to pick up all the gold pieces which are lying about the streets, and expect to do better than in his own home among his own friends? When a young man has a definite engagement offered him in some foreign country it is perhaps well for him to accept it, although even that is doubtful, if he can get, say, two-thirds of the salary at home. To go wandering off on a wild-goose chase is always the poorest kind of policy, even granting that a man may have a gambler's chance of making a lucky hit. He has the same chance at home.

The Railways of the United States in 1888.

It is certainly a singular coincidence that two important statistical railway publications, the introduction to Poor's *Manual of the Railroads of the United States*, and the first Annual Report on the *Statistics of Railways of the United States* by the Interstate Commerce Commission, should reach us in the same week, and both of them, we may add, so late in the week that it is impossible for us to properly discuss either record in the present issue. One alone we might have managed possibly, but as each contains very important matter, and as each is, to some extent, in conflict with the other, we cannot do justice to either on a day's notice, and must postpone part of our discussion to a following issue.

Poor's *Manual* has the advantage of age and experience in the collection and presentation of statistics, and the Interstate report, that of its official character and of its superior machinery for collecting, and if necessary, exacting facts. It is becoming increasingly embarrassing to distinguish between them, to decide, when the question arises, which is entitled to credence, and it is not without significance, nor perhaps without intention, that their "years" differ six months from each other, so that direct comparison is impossible; the 1888 of "Poor's" ending Dec. 31, and that of the Interstate report ending June 30. There is really less difference in their dates than might be inferred from this fact, however, because all the Interstate reports are actually for the date given, whereas Poor's *Manual*, not having power to compel reports, has to take them for such dates as are offered, which is often June 1 or Sept. 1, and only in a minority of cases up to the end of the calendar year. The real difference of date in the reports, therefore, is not much more than three months, so that, so far as that consideration is concerned, a fair degree of agreement between the two ought to exist.

Such, however, is hardly the case. There are very wide discrepancies between them. In large part these are due to the fact that Poor's statistics are more complete. The Interstate statistician, having to wait for official reports (as a rule) before he feels at liberty to include them, naturally errs by omission in many cases as compared with Poor; and this is especially natural in a first annual publication. The immense labor of organizing a bureau for digesting all the long list of records which are now, we rejoice to say, exacted from every railway in the United States, is something which every one who has had to do with statistics can appreciate. The able statistician of the Commission, Mr. HENRY C. ADAMS, has in fact done wonders to accomplish as much as he has, and may reasonably ask for the indulgence hinted at when he says:

> It should be remembered that this is the first attempt at uniform railway statistics for the entire country, and that less than six months have elapsed since the work of compilation was begun. This seems ample explanation for failure to undertake an interpretation of the facts presented.

It certainly is an ample explanation for such failure, and also for a failure to present completely all the facts. We shall, no doubt, witness a steady improvement in this respect, and if the commission continues its work with the energy with which it has begun, and uses due care to have its statistics promptly issued, Poor's *Manual* may lose the pre-eminence which it now has as the standard railway statistical record, although there will always be a great need and an important field for it, which no merely statistical publication will fill.

One most important result the Interstate Commission has already accomplished, which we do not hesitate to say would alone have warranted its creation, and all the expense therefor which has so far been incurred. It has virtually unified practice as to the form, substance, and date of reports, in which there was before a most unhappy and distracting confusion. On page 4 of the current volume it is stated:

> A committee composed of one representative of each of five States, a representative of the Interstate Commerce Commission, and the President of the Association of American Railway Accounting Officers, was charged with the revision of the Interstate Commission's form for annual returns from railways. The members of this committee spent considerable time in discussing the details of the form, and, as their report was adopted by the convention [of Railway Commissioners] *the form issued by the Interstate Commerce Commission, as amended by the Committee, may now be said to be the official form for railway statistics in the United States, both State and Federal.* It will doubtless require some time for the State legislatures to adjust their laws so as to permit railway commissioners to adopt the form recommended by the convention; but an important step has been taken when the intention of recommending such changes is declared, without a dissenting voice, by a convention of State Railway Commissioners.

It is, indeed, an important step, and in connection with the very complete form which was then adopted, and with continued energy in digesting and abstracting the reports, ought soon to lead to very important additions to our knowledge of the actual facts of railway practice, and, we may add, to have a decidedly steadying effect on eccentricities of railway bookkeeping. All this could never have been accomplished without the organization of a national commission. The States working separately could accomplish good in certain narrow fields, but in other respects were making confusion worse confounded.

The completeness of this now accepted form of returns may be judged from the fact, which we have before noted, that it is bound in paper boards, and covers in all 41 pages, with an average of perhaps 30 or so items on a page. From one point of view, it is a hardship for railway companies to be obliged to make out so extended a report, covering many items which they would not otherwise, perhaps, take the trouble to determine and record. When each State had a different form, and a company was called on, perhaps, to make out five or six different statements, covering five or six different dates, it was indeed a hardship. But there is not a fact called for in the statement which it is not for the interest of the companies to have upon its books, and therefore we hope the commission will insist hereafter upon having all of them fully reported, and not accept the statements which, from set purpose or otherwise, appear so frequently in State reports: "Accounts not kept so as to show this," etc, etc.

The only improvement which we can suggest in the form of returns—and this is an important and necessary one—is that there should be printed at the foot of each page certain explanatory notes as to just what is meant by each question. This is by no means self-evident, and great confusion and inaccuracy may arise, with the best intentions on the part of the accounting officers, in filling out some of them. For example, there is a return of cars "in service," passenger, parlor, sleeping, refrigerator, etc. Does this mean cars owned, or all cars regularly running over the road, or a pro rata appointment? We may be quite sure that some will interpret the meaning as one thing, and some another, and so correctness of totals will be impossible; and so with many other items, which it is impossible for us now to particularize.

We publish in another column some considerable abstracts from the introduction to Poor's *Manual*, giving what are, on the whole, the most trustworthy facts as to the actual aggregates of railway operation during last year. It rather shakes one's confidence in the work, however, to see contradictary statements appear in its pages about so elementary a fact as the mileage constructed or reporting operation in each year. Thus, on the first page of the introduction, we are told that the mileage constructed up to the end of the year 1888 was 156,082, and this statement is repeated consistently in following pages, the total, 154,276, which appears in two detailed tables, being plainly due to the fact that 1806 miles did not get reported in time to be included in them,—a very pardonable and necessary discrepancy. Similarly the "miles operated" is reported at 145,341, a statement which is everywhere adhered to. But in the records of past years, as to which we might suppose that the facts would be determined, there are some quite inexcusable minor discrepancies, extending as far back as to 1860.

Thus on the two facing pages vi and vii, there are two fundamental tables, one showing the mileage by States and groups for the years 1835, '40, '50, '60, '70, '80, '85, '86, '87, '88, and the second the total for each year in the whole United States. The only pardonable discrepancies in such a table are those occurring in the later years, if indeed these be pardonable. Certain corrections from year to year are necessary, as defects in previous years' records are discovered; but it would seem as if the same records in the same issue might be the same, and as if discrepancies from year to year might be confined to the last four or five years. As a matter of fact, these two facing tables compare in the following bewildering way:

Total U. S. Railway Mileage.

	As per p. vi.	As per p. vii.	Difference
1835	1,098	1,098	0
1840	2,818	2,818	0
1850	9,021	9,021	0
1860	30,626	30,635	−9
1870	52,922	52,914	+8
1880	93,296	93,296	+5,000
1885	128,361	128,309	−52
1886	136,469	136,469	0
1887	149,301	149,281	+20
1888	156,082	156,082	0

The large error in 1880 is simply due to a misprint, such as should not occur in so important a place, the actual aggregate by both tables being 93,296; but the remaining four discrepancies, all small, and all for old dates, are not so readily pardonable.

Still, "Poor's" is in general fairly reliable, and it has done so much good and valuable work, which would otherwise not have been done at all, that we are not disposed to find

too much fault with what are after all mere matters of detail, not affecting sensibly the value of the substance. The main facts of each year, we do not question, are correctly shown in its tables. In this question of distance, the Interstate statistics, which were most carefully compared, and are alleged to be correct, show 149.902 as the total mileage of the country on June 30, 1888, which implies the considerable difference, from "Poor," of about 1,500 miles at least, but, after all, that difference is only 1 per cent.

In one most important respect the statistics of Poor are in advance of those given by the Interstate report: they give aggregates by groups of States as well as for single States and for the whole United States. We earnestly hope that the very judicious grouping of Poor's *Manual*, which we have copied in preparing our "Manual of American Water Works," and which has been otherwise very generally used, will be copied by the Interstate Commerce Commission and also by the 1890 Census, and thus made standard. The necessity has become a very evident one, especially for railway statistics; and it is practically impossible to draw comparative conclusions from any kind of statistics arranged by States in alphabetical order, as is now the custom in all government statistical publications.

On the other hand, if the country be divided up into groups of five or six States each, only nine such groups are required, viz., New England, Middle, North Atlantic, North Central, Northwestern, South Atlantic, South Central, Southwestern, Pacific; and it is both profitable and easy to compare the aggregates and averages of these groups with each other, while so large a proportion of the great railway systems are confined to one of these groups that it is not impossible so to apportion their returns as to give correct aggates for each group,—a thing which it is a practical impossibility to do for each State separately.

As we find ourselves compelled, for lack of space, to postpone to another issue any proper review of the statistical records in these two valuable volumes, we confine ourselves now to noting further one or two incidental features. The general form of Poor's introduction is improved in several respects. The statistical records for the new grouping are for the first time comparative, those groupings having first appeared in the last volume; and they are very full and complete, showing a very heavy growth in traffic from last year, as we shall show next week. The practice of giving operating totals for each State is dropped, however. A very interesting table of average freight rates on 18 railways, 1868 to 1888 inclusive, is given; and a table of the growth in amount in rolling stock since 1877, which shows the following startling figures for 11 years' progress:

	Locos.	*Pass. cars.*	*Baggage, etc.*	*N't cars.*	*Total cars.*
1877	15,911	12,083	3,834	392,175	408,092
1888	29,398	21,425	6,827	1,005,116	1,033,368
Increase	13,487	9,372	2,973	612,941	625,276
Incr. p. c.	85	78	77	156⅝	153

Considering that the increase in number has been accompanied by a very great increase in weight and capacity as well, of both passenger and freight cars, it will be seen how great an increase in operating efficiency is implied by the fact that 85 per cent. more engines are handling 153 per cent. more cars.

A very useful table, showing the area, population, miles of railway, assessed valuation, and the relations between these, is for the first time given for the current year of publication. We reproduce this table elsewhere. Such tables have been given before for the year preceding, but never before in the same year with the statistics on which it is based. This new display of energy may not be wholly disconnected with the example set in our "Manual of American Water Works."

As a whole, Poor's *Manual* gives every evidence of keeping up to its old high standard, and of continuing a useful and indispensable publication; while the first Interstate report gives promise, which still awaits fulfilment, of still more valuable work to the student of railway affairs. We cannot close this first notice without commending to those in charge of both these publications the use of the Thacher computing instrument, for determining their percentages and ratios. By its aid the computations can be made much fuller and more accurate with far less labor.

CORRESPONDENCE.

The Harbor of Bilbao.

PHILADELPHIA, Pa., July 29, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Being the author of the synopsis of the improvements of the harbor of Bilbao, which Mr. ARTHUR MARICHAL, in your issue of July 13, seems to condemn as unfounded, allow me to state at once that I have derived my information from the "Memoirs of the Society of Civil Engineers of Paris, February, 1869," pp. 225, 226, in which no mention is made of the curvature of the jetty, nor does it appear from the plan showing the jetty. However, on reading over these pages, I have now discovered a footnote referring to a paper by Mr. DE CORDEMOY, published December, 1888, from which I apprehend that Mr. MARICHAL'S estimate of the middle ordinate of the jetty is correct enough at 82 ft. But can anybody from this infer what the curvature of the jetty really is? As a matter of fact, the jetty is represented by an arc of a circle of only 15°; and Mr. DE CORDEMOY, in his paper of December, 1888, referring to it says: "The arc differs hardly from a straight line, and the centrifugal force developed by the velocity of flood or of ebb current is a quantity which can be absolutely neglected. I do not hesitate, therefore, to say that, in my opinion, the slight curvature of the jetty has had no influence whatever on the scour of the channel. . . . Were the jetty perfectly straight, the results would have been exactly the same." (Mem. Soc. Civ. Eng., Paris, December, 1888, p. 877.)

Mr. MARICHAL, in his original remarks, after calling attention to the fact that two parallel jetties at the entrance to the river of Bilbao had failed to maintain a channel, says: "The engineer, Mr. DE CHURRUCA, proposed to build a single concave jetty. This was completed in 1888, when it was found that the channel was 11 ft. deeper than before." (ENG. NEWS, July 13, 1889.)

Mr. DE CHURRUCA himself says: "As a consequence of the study of the regimen of the bar, we have deduced the necessity of extending the jetty of the left bank in a line slightly curved" (Mem. Soc. Civ. Eng. Paris, December, 1888, p. 876.); and farther, on the same page, he says: "If, against my expectations, after the execution of the works, the experience shows the necessity of extending the jetty of the right bank, there will be time to do so." It seems strange that Mr. MARICHAL should select such important facts, and try to bring out as a prominent feature what is considered by Mr. DE CORDEMOY to be the most unimportant one, viz., the curvature of the jetty.

L. D'AURIA.

THE IMPROVEMENTS OF THE HARBOR OF BILBAO.

M. L. d'AURIA sends us the following notes on the improvement of the harbor of Bilbao as vindicating the methods adopted by United States engineers:

The problem of the improvement of the harbor of Bilbao, Spain, was the scouring away of a bar formed at the entrance of the river Bilbao, with the following facts being known:

(1) The bar is outside of the parallel jetties already built.

(2) The sand which feeds the bar is provided by a limited sand beach (Las Arenas), located on the right bank.

(3) The mean or equinoctial range of tide is about 14.8 ft.

The engineer in charge, M. EVARISTE DE CHURRUCA, proposed (and it was accepted) to extend one of the two already existing jetties, with the proviso that, if necessary, afterward he would extend also the other.

In selecting the jetty which was to be extended first, he gave preference to that of the left bank, that is, the one which is opposite to the sand beach feeding the bar; and in doing so the bar was quickly scoured away.

Referring to the practice adopted by United States engineers in similar cases, Prof. L. M. HAUPT, in his paper, "Harbor Bar Improvements," published in the Franklin Institute Journal for July, 1889, remarks: "Thus, the source from whence comes the sand forming the bar being known, the remedy would seem simple, and the first requirement would be to keep sand out of the ebb channel by suitable obstruction, which would not seriously oppose the free ingress of the tide.

"The barrier must be placed between the source of supply and the channel. What must be thought, then, of a policy which invariably directs the construction first of the jetty on the farther side, where its effects are soon manifested by the large shoals created in the natural path of the ebb currents, and which they are obliged to roll on, if possible, into deeper water, thus pushing the bar seaward, adding to the ultimate cost, increasing the undermining of the work, and finally burying it under the original bottom? As well might a snow-fence be placed on the wrong side of a railroad cut to prevent it from filling with snow."

It can be seen from the above remarks that the policy so strongly condemned by Prof. Haupt is exactly the one adopted in improving the harbor of Bilbao; and unless the professor be the victim of a misleading and erroneous idea in regard to the improvements of this harbor, which, we were informed, he discussed before the Engineers' Club of Philadelphia, May 4, 1889, we cannot understand how he could subsequently publish such remarks.

Insects Infesting the Elms.

ALBANY, N. Y., Aug. 6, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In answer to your Flushing correspondent in your issue for July 27, as to elm-tree insects, it would not be inappropriate to refer him to Prof. J. A. LINTNER, of this city, the distinguished State entomologist, whose first report (1882) contains much valuable matter relating to injurious insects. Prof. LINTNER tates that 85 species of insects infest the elm, quoting Dr. PACKARD as authority, hence your Flushing correspondent would do well to be a little more explicit as to his particular insect.

H. A.

Notes on Ancient Measures.

SEDALIA, Mo. Aug. 8, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

When at some future time the history of civilization shall have been written, a chapter will be found devoted to the inventor as a hero, instead of the warrior or human butcher whose monuments now tower so high. Therein will be mentioned the progress of engineering and the surveyor's work in relation to the evolution of peaceful pursuits by man from the barbarous to civilized times. He who is to write this history will find items of interest scattered amongst the records of war, but it will not be an easy task to compile them.

The ENGINEERING NEWS has lately contained some history upon the "chain" as a measure of our ancestors, and other items in regard to the division of land may not be out of place in the same progressive journal. For the purpose of grouping such facts as are connected with the study of ancient land measurements, the following notes are added.

Some 1400 years ago, in England, land was cultivated by the lord of the manor through the aid of his "villeins," and land rent or taxes were assessed by the number of ploughs upon the land tilled.

Oxen were used to drag the crude implement and the number of oxen in a team varied from 4 to 8 according to the nature of the soil.

The use of the plow being taxed by the year, meant the tilling of from 60 to 100 of our present sized acres. We find mentioned in the laws of In (A. D. 630) the *hyde*, which is thought to be the same measure as the *carucate* mentioned in the Battle Abbey Register (A. D. 1200), but these dimensions varied with heavy or light soil, and the land to which the term was applied would sustain a family with its year's crop in grain.

The *carucate* contained four or eight *virgates* according to fertility in A. D. 1200, and was plowed in furrows 10 rods long. This length of the furrow became furlong or "furrow-long," and fields, or "agre" or acre, were portioned off four rods wide. From this we have a field 10 rods long by 4 rods wide or 40 square rods, one acre. No fences were necessary, but mounds were made dividing the land, and these may yet be fairtly traced on some of the old manors which have since become shooting fields for wealthy owners.

The size of our present acre was instituted in the time of EDWARD I. Another measure of land prevailed in the time of the Doomsday Book in the ninth century and this was the "*bovate*," from the Latin word for oxen, and meant the area of land that a team of oxen with one plow could cultivate in the year, and differed with the quality and topography of the land.

The above notes may serve to bring forward others who are interested in the study of civilization with regard to ancient instruments and land measurements.

and by adding and piecing old records left on the sands of time, our journal will contain a fund for the writer of the "Ancient History of Surveying."

As far as my reading goes, my information is that all linear dimensions are taken from parts of the human body. Thumb for inch; hand, foot, fore-arm, arm length, outstretched arms (fathom), and to this day our mothers use the span and finger length, and perhaps sing the future surveyor to sleep while they rock his cradle with:

"Twice around the thumb,
Once around the wrist;
Twice around the wrist,
Once around the neck;
Twice around the neck,
Once around the body."

If this old song does not rhyme, the facts asserted are as well grounded in our memories as that "a pint is a pound the world around," and this "rule of thumb" will be found to fit in more cases than with the old lady who thus sold the hunter a pound of shot during the absence of her better informed husband from his country store.

The metric system which has made such progress is founded upon the size of the earth, with the theory that if, by some future catastrophe, the human race should become engulfed, the "next generation" could replace the measurement with its exact counterpart. Unhappily, the length of the meter now in use is not what it was intended to be by its promoters, but it is as easy to replace as to make the yard pendulum beating seconds, which is supposed to be the length of the "standard" and is not.

It is a fact undisputed that since the building of railroads and the use of steam in navigation the world is growing smaller, and the average man acquires more information about the ways and methods of his neighbors in a foreign land. Measurements as well as civilization tend to a common ideal from the various points in the dim past whence they began, but it has taken the "perch" many years to combine itself into the score of different dimensions it has at present in the United States. Let us hope that this unwieldy "perch" will also soon be an item of ancient history, so that it will not be necessary for the surveyor to place sixteen men and a boy in a row, as they come out of the meeting-house, toe to heel, for obtaining the length of a "pole" or sixteen and one half feet.

As man, so his measures are "fearfully and wonderfully made," both of great antiquity, and if the origin is not, like the ways of Deity, "past finding out," the study of the problems lately given as to the Gunter's Chain are instructive and interesting to the student of the progress of our science.

F. P. K.

The Parker Automatic Water Gate vs. the Bear-Trap Dam.

MENOMONEE, WIS., August 5, 1889.
TO THE EDITOR OF ENGINEERING NEWS:—

Mr. N. S. MACMINN, C. E., of DuBois, Penn., in his reminiscences published in your issue of July 27, has discovered that the Parker Automatic Water Gate is the "old Bear-Trap Dam, an invention of two generations ago, with but slight variations."

Mr. MACMINN'S article is quite readable, but fails to give the "variations" due credit. If he will again turn his thoughts backward, it is quite probable that he will be able to call to mind many other inventions of two, or even more, generations ago, which answered the purpose required of them to a limited extent, and which required only a few variations to cause them to spring at once into prominence, and be of some practical value to the world.

The phonograph, for instance, was an expensive toy, of no use whatever for a number of years, until Mr. EDISON supplied the "variations."

This same Bear-Trap is another striking instance. It has been in use a great many years, but was practical to a limited extent only. If elevated above an angle of about 30° it is almost impossible to handle it, and a 7-ft. head is about the limit, though in rare instances it has been made to hold a 10-ft. head. With our gate we are not at all particular whether the head required is 7 ft. or three times that height, or whether the gate is elevated to an angle of 30° or perpendicular,—the folding upper section or leaf, i. e. the "variation," will cause the gate to respond to the will of the operator, no matter what the pressure may be or how high the head. The apron or idler of our gate is simply to protect the folding section, and may be made long enough to slide on the bed, or may be made so that the toe will strike just below the joint in the folding section. In this case the lower section of the fold is made somewhat longer, and the toe slides on strips on the section, and when depressed does not extend beyond it. This method of construction shortens the bed of the dam and is preferred by some and will perhaps be adopted in most cases. The idler may be made in the form of a rack, dispensing with the necessity of using the sand boxes.

We have, as a matter of convenience, in our cuts and explanatory remarks shown only the "side flume" manner of supplying water for operating the gate. The side flume is not a necessity, however. In cases where the saving of space is an object, and in old sluiceways where it is not convenient to make a change, or in any case where it may be preferred, the water may be supplied through a rack in the idler, or directly above the upper shaft, thence beneath the gate through small "gate ports," simply arranged and as easy to manipulate as the valves shown in the cut.

Another advantage possessed by the Parker gate over the old Bear-Trap is in the length of the bed required.

In order to make the Bear-Trap a success, it must have nearly 4 ft. between shafts for each 1 ft. of perpendicular rise, whereas, in the construction of the Parker, we require only 2 ft. 1 in. of bed for each 1 ft. of perpendicular rise.

Owing to the great length and strength of timbers required, the old Bear-Trap is not practical for high dams. Were it possible to construct one 20 ft. high to stand the enormous pressure, it would require a bed over 75 ft. long. We will construct a gate 20 ft. high with less than 42 ft. of bed and guarantee satisfactory results. We have use for just such dams in this Western country, and expect within a short time to put in several gates in one dam, each 20 ft. high and 100 ft. wide, the total gateage being over 8,000 sq. ft. perpendicular rise. Our Mr. PARKER has experimented with the Bear-Trap for many years, his first acquaintance dating back to 1855, and understands its construction and operation thoroughly. It has been his constant study to produce something more satisfactory and less expensive than the Bear-Trap. He tried many schemes, but without success until he struck the idea of the folding section, which is the "variation" that produced the desired result,—a result that many eminent engineers have striven for but to no purpose. The right of discovery belongs to THOMAS PARKER, and to him credit should be given.

PARKER AUTOMATIC WATER GATE COMPANY, BY
E. J. NEWCOM, *Secretary*.

Local Associations in the Am. Soc. C. E.

The following draft of a report on the organization and reorganization of the American Society of Civil Engineers was prepared and signed by three of the seven members of the committee appointed in 1885 to report on that subject, viz.: Messrs. A. M. WELLINGTON, J. J. R. CROES, and CHARLES PAINE. The other four members of the committee, Messrs. METCALF, MACDONALD, CHANUTE, and BRADLEY, objected to the report for various reasons, principally as not being radical enough, and not going far enough to induce the local societies to seek an organic union with the Am. Soc. C. E.

The report was put in type and tendered as a minority report; but not being accompanied by any majority report, the technical objection was made that it was not in order unless accompanied by a majority report and that consequently it could not be received. Therefore the printed copies were not distributed at the meeting, nor has the report ever before been published. There being now again a movement for a radical reconstruction of the Society's constitution, and a committee on that subject being at work, the report may be of interest as bearing on the work they have now in hand. The progress of time has indicated that some changes in the recommendations of the report would be well, as noted below it, but we give the draft as originally made:

The committee appointed to consider various questions connected with the organization of the Society deem that the true question submitted to them is whether or not our present organization falls short in any degree of fully attaining the purposes aimed at by the Society, and if so, whether these defects can be corrected without greater injury in other directions. Their view of the objects for which this Society exists is as follows:

A primary object is the elevation of the profession of engineering, by associating in one comprehensive organization all those who have, by education and practice, attained a certain degree of proficiency which entitles their opinion on engineering subjects to respect.

Another object is the mutual improvement of the Members, by the discussion of professional subjects and the interchange of ideas.

Another object is the social advantages of such organization for promoting acquaintance among men of practical science and of kindred pursuits therein.

Finally, another object of the Society, which, it is believed, the membership in general have much at heart, is to encourage a high professional standard and a strong professional *esprit* among the younger and rising men of the profession, by affording them opportunity to become connected with the Society and to share its technical advantages early in their professional life, rising through its various grades as they advance in experience.

While all these ends may not have been fully attained, it would appear that, in so far as they have been attained, the policy and practice of the Society has been national in the most comprehensive sense of the word, and uniformly directed toward securing the ends named as fully as possible. Every reputable and properly qualified man, wherever residing, is eligible to membership of a grade corresponding to his proficiency, as indicated by the positions he has filled and the work he has done, and to an equal voice in the management of the Society. The papers presented for discussion are required to be free from advocacy of merely personal interests, whether individual or local and to be, to some extent at least, novel, and not in controversion of established facts.

The only local feature in the Society's organization is forced upon it by the requirements of the law, that to hold property and transact business, an association must have a local habitation and an organization perfected in compliance with the statutes of the State in which its place of business is situated. The practical effect of this has been, it is true, that residence near the general headquarters of the Society has possessed certain attractive features which those residing further from them could not enjoy; but as those who have enjoyed these extra privileges have paid an extra price for them, it is not ground for just complaint that our organization is not thoroughly national in its character and scope, unless it can be shown that the inequality is remediable in part or whole, and that a remedy is indefinitely neglected.

After careful consideration of the whole matter, the undersigned believe that in the substance of the organization of the Society; in its methods of conducting its business (by which every question not purely professional is submitted to the vote of all its Members); and in its restrictions on undue prominence and attention being given to individual interests, whether of a person or a place, there seems nothing more to be desired.

Certain slight modifications in the classification of the membership of the Society, suggested below, are all that there now seems reason to recommend in this direction. But in the opportunities which the Society supplies for personal intercourse between its Members, and for the face-to-face interchange of opinions on matters of theory and practice, there does seem to be ground for the feeling which has been expressed by many Members, that there is something lacking. The vast extent of territory over which the membership is scattered makes it impossible for many to assemble frequently at one point, and the complaint is made that the privilege of often meeting together is confined to the few whose business lies near the general offices of the Society. There are considerable numbers of members who reside in places far from the central offices, but who would be able to meet elsewhere at stated times, and enjoy the privileges of social intercourse and discussion as fully as if they were at the Society House, and it is worth the serious consideration of the Society whether the opportunity to so meet under the name and with the prestige of the American Society of Civil Engineers should not be afforded them. The fact that so many of our Members are connecting themselves with local organizations, and thus, in some measure at least, dividing their interest and allegiance, indicates that the need is a real one, and as the Membership of this Society increases, the need is likely to be still more felt; for it is not to be supposed that those who have connected themselves with this Society would not prefer to hold meetings under its auspices rather than to form entirely distinct organizations, when the membership in one locality is sufficient for that purpose. As there is now, and under the proposed modified classification of membership will be still more, an appropriate place in the Society for every engineer of good reputation who desires a connection with it, no real necessity for the forming of such separate organizations appears to exist. Some modification of the dues now in force may appear to be desirable, but as that is not a constitutional question, and can be readily varied from time to time, it has not seemed necessary to consider that question.

As an indication of the existing status of the Society in several cities, the Secretary of the Society has furnished the following tally of the Members, Associates and Juniors residing in or quite near to various large cities, as the Society existed January 1, 1886:

		Per cent.
Out of a total in the three grades of.....	853	100.0
There are in New York, Brooklyn or Jersey City.....	145	
And outside of those cities, within the limits of resident membership.....	31	
	176	21.4

In ten cities, as below summarized, in which local engineering societies exist, the reare	185	22.5
And in seven other cities in which engineering organizations do not as yet exist (viz., Baltimore, Cincinnati, New Orleans, Washington, Milwaukee and Detroit), there are	72	8.7
Leaving as residents of the smaller towns and country districts of the United States	31	
In Canada (Montreal, 6)	27	
Residing abroad	32	
	300	47.4

The ten cities in which local organizations exist, with the number of our Members of all grades residing thereat, are as follows, in order of population:

Philadelphia	39	San Francisco	12
Chicago	19	Cleveland	11
Boston	36	Minneapolis	7
St. Louis	29	Denver	1
Pittsburg	17	St. Paul	14

Total, as above 185

The seven other cities mentioned now have:

Cincinnati	15	Washington	13
Louisville	9	Detroit	10
Milwaukee	10	Baltimore	7
New Orleans	8		

Total, as above 72

New York City, with its two great suburbs, had, in 1880, a population of 1,893,700, or 10,750 for each of our present Members residing in them. The ten cities having local organizations had, in 1880, an aggregate population of 2,797,000, or 15,100 for each of our present Members residing in them. These figures reveal clearly how truly national and representative is our membership, and also seem to indicate both the desirability and possibility of the organizations of sections for the holding of local meetings. But in any provision made in the Society law which may provide for such meetings, the principle should be clearly recognized that the Society is a unit, and cannot be looked upon as in any manner local or provincial, and that its interests are not those of a class, a city, a State, or a geographical division, but are those of science and of the whole country. Therefore, it seems clear that all questions of policy and of business should continue to be settled by the vote of the Members acting as individuals—and not as citizens of a State or province, or as Members of a local club or section—the actual numerical majority to rule, irrespective of locality.

Bearing in mind what has preceded, it is suggested that the desired end may be attained by some such provision as the following; which should be in the form of

AMENDMENTS TO THE CONSTITUTION.

First.—In any city or county more than 50 miles from New York City, in which there are not less than 25 persons connected with the Society in its various grades of membership, residing within a radius of 10 miles, at least five of them being Members; such persons may, by an affirmative vote of three-fourths of their number, due notice being given to all, associate themselves as a local organization under the laws of the State in which they reside, with by-laws not inconsistent with the Constitution and By-laws of this Society; and may, with the consent of the Board of Direction of the Society, be entitled a Section of the American Society of Civil Engineers, and as such may hold meetings for professional discussion, and may establish a reading room and library of professional literature.

Second.—When a section shall have been duly created, all persons connected with the Society who may reside within 10 miles of the rooms of the Section shall be notified thereof, and shall be deemed to be members of the same and subject to its by-laws, regulations and dues.

Third.—Any Section which shall establish and occupy a reading-room for its members shall be entitled to receive from the Society, free of expense, one copy of all publications of the Society, and one copy of such other technical publications as may be obtainable, by exchange or otherwise, at a net cost to the Society of not exceeding $100, for the exclusive use of its reading-room.

Fourth.—Professional papers and the discussion thereon, presented at meetings of a Section, shall be the property of the Society, and shall be forwarded to the Secretary of the Society for publication under the rules in force regarding publications of the Society. Records of meetings of Sections shall be published by the Society, and distributed in the same manner as records of meetings of the Society.

Fifth.—All members of any section shall pay for the use of such Section an additional annual assessment, to be determined from time to time by the section, and the proceeds of the same shall be devoted to the legitimate current expenses of the Section.

Sixth.—All those who may be hereafter admitted to the Society in any grade, who reside, at the time of their admission, within 50 miles of the general headquarters of the Society, or within 10 miles of the rooms of any Section, shall pay, in addition to the established general entrance fee to the Society, a further entrance fee, to be determined by the Society, and to accrue to the general fund in the case of those residing within 50 miles of the general headquarters; and to be determined by the Section, and to accrue to the Section, for the use thereof, in the case of those residing within 10 miles of the rooms of any Section.

It is further believed that a large increase in the membership of the Society may be attained, as well as certain other considerable advantages, by a slight modification of the Classification of Members in the Constitution, as follows:

1. MEMBERS.—Electrical engineers to be added to the list. No person under 30 years of age to be eligible as a member.

2. ASSOCIATE MEMBERS.—Engineers not less than 28 years of age, who have been in practice for 5 years, or engaged in teaching their profession; and who, for at least one year prior to their application, have held a responsible position in the design or direction of engineering work.

3. ASSOCIATES.—Persons not less than 24 years of age, who have had actual practice in some of the branches of engineering, or in the arts and sciences relating thereto, for not less than 2 years.

4. FELLOWS.—Persons not less than 30 years of age, who come under the following classification (which is that of the present grade of Associates): A manager of a railroad, canal or other public work; a geologist, chemist or mathematician; a proprietor or manager of a mine or metallurgical works; an architect or a manufacturer; or one who from his scientific acquirements or practical experience has attained eminence in his special pursuit, qualifying him to co-operate with engineers in the advancement of professional knowledge, but shall not himself be practising as an engineer.

5. STUDENTS.—Persons not less than 18 years of age, who are engaged in the study of engineering, either in engineering schools or under the direction of Members of the Society in any grade, and who intend to become engineers.

Students shall cease to be connected with the Society on reaching the age of 25 years, or on election to a higher grade of membership. Admission to the grade of Student shall be by vote of the Board of Direction, on the recommendation of the Member under whose direction the applicant is engaged in study.

In the light of recent experience, there having been formed already without any warrant or countenance by the Constitution, three local "Associations," within the American Society of Civil Engineers (at Cincinnati, St. Louis, and Chicago), it would seem wiser that any local organizations should be termed "Associations" rather than "Sections," and the local dues should by all means be made uniformly the same as the "resident" dues at New York, and the excess collected on the Society's bills and paid over to the local treasurers. Entrance fees, likewise, should be uniform everywhere and to all.

With these changes, and with the membership grades of the Am. Soc. C. E. reconstructed about as outlined above, so as to give an appropriate place in it (which now there is not) for all persons likely to be connected with a local society, we fail to see what further effort can be necessary to "affiliate" such organizations with the Am. Soc. C. E., beyond some provisions by which, if any local organization should agree to dissolve and convert itself into a local "Association of the Am. Soc. C. E.," and turn over its property to that Society, the entrance or other fees paid to such local organization should be credited on the Society dues. The only proper way for "affiliating" any man or body of men with such a national organization is by individual application and ballot. Otherwise the unity of the body is destroyed; and the most influential fraction of the local organizations being already connected with the Am. Soc. C. E., if some measures like the above were carried through, it would not be long before most of the local organizations would see that they would be stronger and better off as local "Associations" of a National Society than as entirely independent organizations.

It would also, probably, be far better to consolidate the two almost moribund grades known as "Associates" and "Fellows" into one grade of "Associates," than to retain both as in the above draft. The qualifications for these two grades are now practically identical (being only that the candidate must be a reputable man engaged in scientific pursuits) and the only difference between them is that Associates pay annual dues, and Fellows pay a lump sum in lieu thereof. Giving every applicant the same choice as to mode of paying dues, which Members now have, all need for the two grades disappears.

The contrast in the following figures will show how nearly moribund these two grades now are and also what a tadpole-like structure generally the organization of the Am. Soc. C. E. is compared with the Inst. C. E.

Am. Soc. C. E. Membership.

	1885	1889	Incr.
Members	657	979	322
Juniors	77	158	81
Fellows	57	54	
Associates	34	50	13
Total	825	1,241	416

In contrast with these figures we have the following:

Inst. C. E. Membership.

	1885	1889	Incr.
Members	1,416	1,657	241
Assoc. M.	1,844	2,613	769
Associates	502	450	(— 52)
Students	722	989	267
	4,484	5,709	1,225

The contrast is sufficiently striking. The rapid growth of the Institution is almost entirely in the lower grades, which far outnumber the higher grades; the growth of the Am. Soc. C. E. is almost wholly in the highest grade, which is the only one with any life in it.

There was an amendment offered last year creating grades in the Am. Soc. C. E. of the same names as those in the Institution, and practically of the same character as those above recommended, which failed to pass. It was probably, however, from certain objections to the form of the amendment, which in some respects was carelessly drawn, and still more carelessly amended in the annual meeting, rather than from objection to its substance, that it failed to pass. The amendments, indeed, appeared to have been offered with the express purpose of defeating the measure. It is probable that a measure making the grades of the Am. Soc. C. E. Member, Associate Member, Associate, and Junior, the qualifications for Member being somewhat higher than now, and for the Junior somewhat lower, with the new grade of Associate Member to fill the gap thus created, and the dues and entrance fees of Members and Juniors modified in accordance with the change in qualifications demanded, would meet with general acceptance.

Chief Engineer Stanton on the Denver, Colorado Canon & Pacific R. R.

At a late meeting of the directors of the Denver, Colorado Cañon & Pacific R. R. Co., Chief Engineer ROBERT B. STANTON made a report on the survey as follows:

We left Denver May 22, reached Green river the next evening, and spent the 24th in preparation for the trip. We started out down the river May 25, with a party of the following people: FRANK M. BROWN, E. A. REYNOLDS, J. N. HUGHES, GEORGE E. HOWARD, EDWARD COE, W. H. BUSH, JOHN HISLOP, T. A. RIGNEY, F. A. NIMS, C. W. POTTER, G. A. SUTHERLAND, E. W. TRACY, P. M. HANSBROUGH, H. C. RICHARDS, G. W. GIBSON, and myself. In an hour we reached the first rapid on the Green river. All the boats of the party were taken down without running the rapid except Mr. BROWN'S, in which Messrs. HUGHES, REYNOLDS, and BROWN made a successful run.

From the point of that rapid, five miles below Green River station, there are no rapids for the distance of 115 miles to its mouth. We sailed that distance, and reached the mouth of Green river on the afternoon of May 29, passing through Labyrinth and Stillwater cañons. On this trip we had considerable sport, shooting deer and generally enjoying ourselves. It was a very beautiful and winding river.

We commenced our survey at the head of the Colorado river on the morning of May 30. On the next day, May 31, we came to our first bad rapids at the head of Cataract cañon, about 6 miles from the head of the river. The next day we spent in making portages and moving our boats down the river, without any work upon the survey. From that point for 20 miles the rapids are almost continuous, and in that 20 miles is the greatest fall that the river has in any portion that we were over, falling in one place 55 ft. in a distance of 2 miles. We made very little progress with our railway survey for the reason that it took all our time to move our boats down. There's where the bad water was, and we never had an accident. That was a terrible experience for all of us. We were in the water, some of us to our armpits and some over our heads, for days at a time for weeks, making these portages. You put 50 to 75 lbs. of bacon on your shoulders, with the sun registering 132°, and carry it over rocks 5 to 10 and 15 ft. high for a mile, and it is no fun for anybody. We were about two weeks getting over that 20 miles.

During this time we lost the cook's boats and nearly everything in the way of cooking utensils and nearly all our provisions, mostly by being wet and spoiling in the hot sun, so that by June 16, we were practically without provisions, and it was arranged then that Mr. BROWN Mr. HUGHES, and Mr. REYNOLDS, and a picked crew of oarsmen should start on ahead down the river to get supplies at the placer mines, which we believed to be some 40 miles below. The surveying party was to remain. But most of the party became very much alarmed by the short supplies, which we had cooked up and divided, and I was only able to get four volunteers to remain with me at the head of the cañon, the rest of the party going on to the placer mines. Mr. HISLOP, Mr. POTTER, and a negro cook and waiter remained with me, and we worked six days carrying the survey down the river on about one-quarter rations. We carried on the survey, making about 4 miles a day, when a party of three, sent back by Mr. BROWN, arrived with supplies. Then we pushed on down to Dandy Crossing, 4 miles beyond the Dirty Devil. I want to express this,—not one word of condemnation for the

men who went away, but I have the highest appreciation of those four men who stayed. If it had not been for their faithfulness, we should have had to drop the survey for the time being. That completed our line to the Dandy Crossing, 55 miles. In 40 miles of the Cataract canon there were 74 distinct rapids, and 4 in the remainder of what is called Narrow cañon. Many of these rapids we made portages around, and quite a number we ran through.

We completed our survey to Dandy Crossing on the evening of Monday, June 24. We spent one day there. There it was decided that we should separate the party, and Mr. BROWN, myself, and six others should go down the river by our boats rapidly to make an exploration, leaving our party of surveyors, under the charge of Mr. W. H. BUSH, to come along and carry on the survey. The party under Mr. BUSH are there yet, working along the shore. We have heard nothing from them. But there is no danger, as the country is open. At this point Messrs. HUGHES, FERRY and RIGNEY left the party, and Mr. HARRY MCDONALD was employed there as an additional boatman. On the morning of the 26th, the boats went on down the river 15 miles, and stopped at the placer mine at the town of Tickaboo. There we stopped to repair our boats, and by the kindness of Mr. CASS HITE, we were enabled to use his tools. We left there on the afternoon of June 28.

From Tickaboo to Lee's Ferry, a distance of 110 miles, we had another delightful sail down a quiet river very much like the Green, although there were a number of bad rapids scattered through it, 22 in number, nearly all of which we found free from rocks so that we could run them. Around a few we had to make portages. We were very careful and took no unnecessary risks. We reached Lee's Ferry, on July 2, making the distance of 125 miles in three days. At Lee's Ferry, Mr. BROWN went out to Kenob to purchase supplies, and we lay there until June 9. Then we started down the river on June 8, and it was on the 10th that Mr. BROWN was drowned.

In going through the rough water in Cataract cañons before, BROWN's boat had been capsized, and he, HUGHES and REYNOLDS, were thrown out. They regained the boat, and floated down two miles over two more rapids, and finally landed safely. This incident gave Mr. BROWN very great confidence concerning the ability of the men, even if thrown into the water, to get out.

From the head of the Colorado, the general impression that almost every one has, is that the cañons rise up in perpendicular cliffs from the water's edge, whereas the fact is, that for the whole distance there are few points where perpendicular cliffs rise from the water as much as 500 ft. The sides of the cañon are formed by different strata of stone, and by the breaking down of the hard strata it leaves a slope on the soft strata, so that the whole side is benched up and back, with a talus at the bottom formed of débris. All through the upper part of Colorado to the Marble cañon there are extensive bottoms. Commencing at the head of the Colorado, a railroad line would run the first six miles on good level bottom land. From there down, a distance of 20 miles, the talus formed by the cliffs extends from the level of the water at an angle of 45 deg for from 100 to 500 ft., and in some instances even much more.

From that point to the mouth of the Dirty Devil the rock is harder than that above, and the sides of the cañon are benched back in irregular shape and size, giving, with few exceptions, a good railroad line on one or the other. In this distance to the Dirty Devil of about 50 miles, there are four or five large tracts of land, mostly at the mouths of side cañons, which are comparatively level, varying in length from 2 to 3 miles and in width from 500 to 1,000 ft. In that very bad cañon there is room enough to build pretty good-sized towns above high-water mark.

At the mouth of the Dirty Devil commences the great gold placer mine country. From there for a distance of about 85 miles, a little beyond the mouth of the San Juan river, the course of the river is very straight, and on either side of the river for that distance there is almost a continuous stretch of bottom land, the greater part of which is above high water, so that in constructing a railroad line down the 85 miles on either side of the river, a good portion would be plow and scraper work. In one place there is a continuous stretch for nearly 7 miles. The rest of the line along there is on the same slope or talus that extends 100, 200, and 300 ft. back from the water to the cliffs.

Two miles below the mouth of the San Juan river commences Glen cañon. Through the cañon, for about 40 miles, the river is very tortuous. The greater part of the distance the sandstone cliffs rise in solid mass from the water's edge, except that on the points of each one of these lands there is a large piece of bottom land from 100 to 200 ft. in width. These cliffs are for a greater part of the distance quite low, from 10 to 40 ft. above high-water mark. The remaining portions are from 100 to 500 ft. high. The construction of a railroad through this section would be somewhat expensive; but as the river is quite wide, there is no great difficulty, though on account of its extreme crookedness, for about 30 miles there would be required, in order to get a proper alignment, about fifteen tunnels, varying in length from 200 ft., two of which would be a mile in length each. It is a solid mass of sandstone, and would never require any timbering.

At Lee's Ferry, at the mouth of Pariah creek, the whole country breaks back away from the river on both sides, and for a mile or two it is simply a hillside slope. At the end of this mile or two commences Marble cañon.

The first section of that which is called Marble cañon is entirely composed of sandstone, perhaps twenty miles. It has the same characteristics of the Sandstone cañon above, the sides being benched back in irregular benches offering no particular difficulty to a railroad line, except for about three miles. In that distance the sandstone seems to be very much harder, and rises right up from the water's edge to a height of 100 to 500 ft. in points. It is not a solid mass, as there are many openings. At this point, where this three miles of heavy work is shown, we found the greatest difference between high and low water mark, driftwood being lodged in quantities as much as 85 ft. above the stage of the water when we passed over it. On account of this, it will be necessary to keep the grade line high up, which will throw us upon the second bench, and we shall have to do a little more work in tunneling.

I estimated that I went down that Marble cañon 50 miles, which leaves 30 miles of strictly marble formation. In that distance there were only found two points that would have to be tunnelled. The difficulties and expense are no more than in the sandstone work above.

This line that I have described runs almost altogether upon the east side of the river. At the point where we stopped there is a bold cliff of marble running up a thousand feet high, through which there would be a tunnel a half to three-quarters of a mile in length. It is likely that from the lower portal of this tunnel a bridge would be swung to the marble cliff on the other side, transferring the line to the right or west bank of the river.

In the Marble cañon I have found very much less difficulty than I expected. With the line such as it is, from Grand Junction to the point where we left the river, a distance of nearly 400 miles, and with the knowledge that every one has of the character of the river from the Rio Virgin to the Gulf, and with the information that I can gather of the character of the cañon between these points, this is my conclusion: that, while I know nothing about the Grand cañon personally, it is utterly impossible to crowd into this distance such difficulties as to make the route impracticable. I am, therefore, very anxious to get back there and demonstrate positively that to be true.

By putting in an Indian dug out, and testing its run down the rapids in Marble cañon, we found that the water ran fifteen miles an hour and our boats traveled sometimes twenty-three miles an hour.

A road can be built from Grand Junction to the Gulf of California on a grade not to exceed 10 ft. to a mile. It would certainly not exceed 20 ft. to the mile, if most economically constructed.

On account of the long, heavy swings of the river, the curvature would be light, and it would not be necessary to use more than 6 degree curves. It would give a down-grade avenue for 2,000 miles, for transporting the coal of this State to Lower California.

Some of the rough experiences of the surveying party are narrated in the following account given by Mr. T. A. RIGNEY, one of its members, to a correspondent of the Denver *Republican*:

The survey of the Grand river was completed May 4. At no place on this river did the cliffs exceed 1,000 ft., while the river had an average fall of 5 ft. to the mile. We left the junction of the Green and Grand the same day, as we had to tow our boats to Green river station on the Denver & Rio Grande Western, a distance of 120 miles. As we were short of provisions, there was no time to delay. After going on for eight and one-half days on one-half rations, making a distance of 90 miles, we were on our last meal when we came to the cabin of the Wheeler Brothers, cattle-men, who at once, seeing the condition we were in, set out everything they had for us. Next day at noon we set out for Green river station, where we arrived the next night.

From this point the second expedition started out on May 24. We struck a small rapid 5 miles below Green river station in which the leading boat knocked a hole in her bottom, but which was soon repaired. The party made the head of the Colorado in four days, having seen considerable game, but getting only one deer. Next day, May 30, we adjusted our instruments, repaired our boats, and took photographs; so we did not get started till the 31st.

We made two miles, when, hearing rapids, several went ahead to reconnoiter. They came back shortly and reported a big rapid ahead. The boat towing the raft of provisions being on the other side, we called for them to cross, as it was a better camping ground on the side which we were on. Although the boat was a half mile above the rapids, they were drawn almost into them, when they cut the rope which held the raft to save themselves. They managed to get out just on the edge of the rapid, which was a very bad one. The raft went through, and we found pieces of it scattered all the way down Cataract cañon. Next day we made two portages, which took all day, and stand e only of about three-quarters of a mile. Twelve miles down, while BROWN, HUGHES, and REYNOLDS, were running a rapid, their boat capsized, and all were thrown into the water. They managed to hang on, although they were carried a mile and a half. The same afternoon our cook boat caught on a rock and went to pieces, losing most of the provisions. Five days later, the boats having such large holes in them, it was deemed necessary to pull one apart so as to repair the balance with it.

Having but a little flour left, some sugar, and about two pounds of coffee, it was divided up equally, each man receiving a loaf and a half of bread, one-fourth of a pound of sugar, and one-eighth of a pound of coffee which was supposed to last for a week, or until we got to Hite City. After dividing up the provisions, five men, with Mr. STANTON, stayed back to run the survey, while the balance pushed ahead for provisions. In two and a half days those in advance arrived at Hite City and at once started three men back with provisions. Four days later the line was brought up to Hite City. Here we rested for two days, during which time the boats were all repaired and a new supply of provisions laid in. At this time Mr. BROWN and Mr. STANTON started ahead to Lee's Ferry with six men and three boats, while the balance stayed behind to run the survey. At Hite City, J. N. HUGHES, E. A. REYNOLDS and myself left the party.

We got through Cataract cañon with a grade of 10 ft. to the mile, and curvatures about 6°. So far as I went, the roadbed would not be particularly expensive as no more than two miles of it would be cliff work.

There was only one point where I thought there might be danger, and that was in Marble cañon, where poor Mr. BROWN lost his life. Major POWELL had told him that it was very dangerous, so everybody was on his guard.

Mr. BROWN was universally loved. I never saw him the least excited, and he never lost his temper. His boat was always in the lead, and he was the first to meet every danger.

The following account of the resources of the region tributary to the proposed railway is also given by Mr. STANTON:

It was always considered by Mr. BROWN and all others that the first object of the road is a through line to transfer the coal of Colorado to the Pacific coast, where coal is dearer than anywhere in the United States, and we were all very much surprised to find how much business there was on the line of the road waiting for its construction.

From a point 50 miles south of Grand Junction to Dandy Crossing, 55 miles below the head of the Colorado, it is estimated that there are 200,000 head of cattle within 30 or 40 miles of the river. It is estimated by cattle-men who live in that country that there are from 1,000,000 to 1,500,000 cattle that graze back from the river, besides hundreds of thousands of sheep. While the first object was to transport Colorado coal to the Coast, we find it can be procured vastly nearer the Coast. We were told of coal mines some 20 or 40 ft in thickness up almost every creek. In the Henry mountains coal veins are being worked within twelve miles of the river, and also forty miles up Pariah creek.

The timber in extent is all set out clearly in the government reports and is inexhaustible. Tracts of 20 by 60 miles of magnificent pines grow near the river. In various cañons are also immense groves of sugar maple. One cattle-man made in one season 3,000 pounds of sugar.

The placer mines, commencing at the mouth of the Dirty Devil, extended down 100 miles, although all the sand bars as far as we went would pay and give good colors. The placer mines from Dirty Devil down are principally formed of immense gravel beds deposited on the first and second benches, 40, 60, and even 100 ft above the level of the river. These beds of gravel are from 60 to 80 feet thick. They yield gold from the very top. A recent clean-up by Mr. CASS HITE, at Tickaboo from the gravel at the top of his bed netted him 65 cents per cu. yd. It is estimated by mining men in that section that there are 25,000,000 cu. yds. of gravel in that section of Tickaboo that will pay a net profit of $6,250,000. The lode mines below are rich and glowing accounts of them are given.

All through that section, out of the cañon, going back from the river the resources as to agriculture and fruit raising are great. Barley grows without irrigation. At the mouth of Pariah creek, Mr. W. M. JOHNSON has 160 acres of land on which he raises everything. We had peaches, plums, watermelons, pears, and everything in the way of vegetables.

Mr. STANTON writes us that he intends to return and complete the survey through the Grand Cañon as soon as new boats can be built and a new outfit procured. We hope to produce in an early issue

some of the photographs secured by the party, showing the scenery along this wonderful but little known gorge.

A New Water Level.

This water level is described by P. KABLE in the *Zeitschrift fur Vermessungs wesen*. A tube of thick glass, ¼ in. to ⅝ in. diameter, is bent into the form of a rectangle 7¾ ins. long by 4¾ ins. wide. Before being closed, the tube is half filled with colored alcohol. In use this instrument is held in the hand, and the eye of the observer is brought in the line of the two surfaces of the liquid and levelling rod. No tripod is required, and in many cases the levelling rod can be dispensed with.

As a proof of the accuracy of work with this water level, the author notes the results of a survey in the Alps, where the surface was so irregular as to preclude the use of a base-line trigonometrical survey. The total height was 1,050 ft. above the starting point and some of the slopes inclined 30° to 48°. The total error on returning to the starting point was 1.31 ft.

In another case this level was tested along a road over a distance of 1.86 miles, and the result was checked by accurate spirit levelling, which showed the difference in level between the two terminal points to be 754 ft. The result is given as follows in a translation of this paper in "Abstracts of Papers" of the Institution of Civil Engineers:

Bench Mark	Spirit-Level	Hand-Level		
		By Eye	With Rod	
0.0	0.0	0.0	0.0	0.0
0.5	38.0	37.6	37.8	37.7
1.5	111.9	110.9	110.6	111.0
2.5	158.7	159.0	158.7	158.7
3.0	236.5	227.0	236.5	236.5
No. of Sights	200.	141	224.	276
Time occupied	5 hrs.	1 hr. 25 m.	1 hr. 50 m.	2 hrs. 16 m.

The author believes this level may be effectively used in many topographical surveys, in small field railway work, for roads, water courses, etc. A closed water level of this description and of the dimensions given costs about 50 cts. in Germany or in England.

The Brooklyn Bridge Terminals.

The following vivid and true description of the present condition of the Brooklyn Bridge terminal facilities appears in the New York correspondence of the Boston *Globe*. The facilities remain in substance precisely what they were two years ago, and nothing has been done toward carrying out the plans "adopted" in April, 1888, except to say that they have been changed and revised:

Something must be done, and that shortly, to relieve the present dangers in connection with the entrance to the bridge. Why, the frightful possibilities of accidents encountered every morning and evening in front of the Park Row entrance to the bridge are something terrible to contemplate. At the hours when the multitude are coming to and returning from business, the entire space about this entrance is a surging mass of humanity. An accident there would almost surely put on record a frightful calamity, and the danger of such a disaster is growing every day with the increase in traffic over the bridge.

True, no such calamity has yet been recorded, but it is in no way due to the facilities, and something is liable to happen any day. The big reservoir above Johnstown had been there for years before it broke and laid desolate the valley of the Conemaugh. Still, the danger had been there all the time, and the terrible catastrophe might have happened on almost any day during the past ten years.

Aside from the danger of an accident, the present condition of things is a nuisance, both to those traveling over the bridge toward sundown, and to the thousands who take the Third avenue elevated road at that hour to go up town. It is such a struggle to get through the crowds in the elevated road ticket offices that dozens of people whom I know take more circuitous routes to reach their homes in order to avoid the crowds in front of the bridge entrance.

The present entrance to the bridge is ridiculous. It is absurd. Here is one of the greatest bridges in existence, connecting two of the most important cities in the world, and its entrances on either side are of such a character as to make any competent inquirer who contemplates them laugh in derision. It is a shame, and it would be a disgrace to both cities to allow the crowds who will be gathered here for the great EXPOsition of 1892 to behold it as it is.

Apart from the necessity of accommodating traffic, there should be a beautiful façade at each end of the bridge. The structure should be one of the most beautiful architecturally, as well as one of the most important on the globe.

A VALUABLE LABOR-SAVING DEVICE for draughtsmen's use is described as follows by a correspondent of the *American Machinist:*

A young draftsman came into our place the other day, and was put to work on the board next to mine. With my usual desire to know my neighbor's methods, and profit by them, I kept one corner of my eye on that board to see his "kit" unpacked. Such occasions always interest me, for the new kinks, if a fellow has any, are always accidentally left in conspicuous prominence on the board, just as the new family moving into the neighborhood will leave their best furniture on the sidewalk until everything else is moved in. What struck me most in that youngster's "kit" was an oblong piece of paper with the ends rounded, about 5 ins. long and 2 ins. wide. There were 3 long, thin slots cut in it, 2 round holes cut in one end of it, of different diameters, and 2 square holes in the other end, also of different sizes. I made several unsatisfactory, silent guesses as to its utility and purpose, and concluded to await results. Well, the next day he put a line on the drawing a little out of place. The curious kink now came into play. One slot in the piece of paper was placed directly on that line, the eraser was rubbed over it, and the misplaced line was eradicated as completely as if it never existed, without a blemish on the rest of the work.

The idea is so simple that every one, if he has not already seen the device, wonders that he never thought of it himself. It would seem, however, that paper would be hardly a very durable material for the tool. Very thin metal, or perhaps celluloid, would answer the purpose much better and last indefinitely. Perhaps some of our enterprising instrument makers will put such a tool on the market.

RAILWAYS.

EAST OF CHICAGO—Existing Roads.

Buffalo, Rochester & Pittsburg.—WM. E. HOYT, of Rochester, N. Y., Chief Engineer of the Lincoln Park & Charlotte R. R., sends us the following:

The road runs from Lincoln Park through the towns of Gates and Greece to Charlotte, N. Y., a distance of about 10 or 11 miles. The route is through an undulating country affording light work and easy grades and curves. There are 7 iron bridges and nearly 2 miles of wooden trestle on the line. The principal business of the road will be the transportation of coal and ore. Ryan & McDonald, of New York and Baltimore, have the contract for the grading; J. E. McIntire, of Buffalo, N. Y., for the timber work, and B. P. Smith, of Rochester, N. Y., for the masonry. About 9 miles of the road has been completed and will be opened for traffic Aug. 12. WM. E. HOYT is engineer in charge of construction.

Chateaugay.—This company is reported to have under consideration the building of an extension from Saranac Lake to Lake Placid, a distance of about 8 miles.

Valley (Ohio).—This company has offered to build a branch from Turkeyfoot Lake to Massillon, O., a distance of 14 miles, on condition that the right-of-way be granted by the people along the route. The surveys have been completed and profiles and estimates made.

Lehigh Valley.—It is announced that this company has asked that commissioners be appointed to condemn the right-of-way from Newark, N. J., to New York Bay, for the proposed Jersey City, Newark & Western R. R. giving the company an entrance into New York. The line will parallel the proposed Waverly & New York Bay branch of the Pennsylvania R. R.

Upper Coos.—This road has been completed to Cookshire, P. Q., and work is now in progress between Cookshire and Dudswell Junction. It is expected that the line will be completed to Dudswell Junction by September

New York, Lake Erie & Western.—This company has completed the surveys for a line from Montclair, N. J. via Parsippany to Morristown and Dover, N. J., and it is announced that work will commence soon. The line will be an extension of the New York & Greenwood Lake R. R.

Lancaster & Hamden.—A press report from Tarlton, O., states that construction has been resumed on this road. E. P. Buell & Co., of Tarlton, are the contractors.

Baltimore & Eastern Shore.—Godeffroy & Howe, of Easton, Md., the contractors, are now pushing work on this road. Tracklaying will commence in about one month, and it is hoped to have the road completed by Jan. 1, 1890.

Utica & Unadilla Valley.—J. A. Seno, contractor, has been discharged by this company on the plea that he is unable to complete the work. The road is projected to run from Bridgewater to New Berlin, N. Y., 20 miles. It is stated that new arrangements will be made for the construction of the road and the work be rapidly pushed to completion. DELOS E. CULVER, of Bridgewater, N. Y., is Chief Engineer.

Greenwich & Johnsonville.—This company is considering building an extension from Greenwich to Middle Falls, N. Y., a distance of 3 miles.

White Water.—The surveys for the proposed branch from Harrison, O., to Cincinnati, O., have been completed.

Toledo, Columbus & Cincinnati.—A contract has been closed for 4,000 tons of steel rails to be used on the proposed line.

Evansville & Terre Haute.—Tracklaying has commenced on the Evansville & Richmond R. R., at Seymour Ind., and the line from Elnora to Richmond, Ind., will be pushed rapidly to completion.

Cornwall & Lebanon.—This company has incorporated the Lebanon Belt R. R. Co., to build a belt line transfer railway around the city of Lebanon, Pa.

Manistee & Northeastern.—This road has been completed from Bear Creek Station north 9 miles, since Jan. 1, and construction is being pushed on the remaining distance to Traverse City, Mich. EDW. BUCKLEY, of Manistee, Mich., is President.

Central R. R. of New Jersey.—A correspondent writes as follows concerning the Orange County R. R.:

The road is to run from a point on the Lehigh & Hudson River R. R. 1¾ miles south of Greycourt to a point on the Hudson Connecting R. R. 1⅜ miles north of Burnside, a distance of 10½ miles. The work is very heavy, being almost entirely hard pan and rock work. There will be two iron bridges of 150-ft. and 94-ft. span respectively, one iron viaduct of 7 spans, 30-ft. each, and 2,500 ft. of pile trestle. About 440 men and 122 teams are now at work on the line. Tracklaying will begin about Aug. 12.

Concord.—FRANK R. MERRILL, of Concord, N. H., Chief Engineer, writes us as follows:

Tracklaying has been completed on the Tilton & Belmont R. R., 4.15 miles, and the road will be opened for traffic Aug. 17.——Tracklaying is now in progress on the Lake Shore R. R., running from Lake Village to Alton Bay, N. H., a distance of 17 miles. Caldwell & Varnum, of St. Johnsbury, Vt., are the contractors.—— Grading on the Suncook Valley extension, running from Pittsfield to Barnstead, N. H., 4½ miles, is nearly completed and tracklaying will commence soon.

McKeesport & Belle Vernon.—There remain only about 5 miles more of this road to complete before it reaches Belle Vernon, the temporary terminus. A large force of men are now at work on this distance and it is expected to have it completed by Sept. 15.

Chicago & West Michigan.—We are indebted to J. J. MCVEAN, of Grand Rapids, Mich., Chief Engineer, for the following information concerning the line from Baldwin to Traverse City, Mich.:

The work will be light and grades and curves easy. There will be one iron bridge of 150-ft. span and 1,020-ft. of trestle-work approaches. Nearly all of the right-of-way has been obtained, including 16 miles through Traverse county. Work is already in progress under the contractors, Fitzgerald & Bro., of Lincoln, Neb. Tracklaying will begin about Oct. 1, and the road be opened for traffic by June 15, 1890. H. F. NORTHROP, of Baldwin, Mich., is the engineer in charge of the extension.

Pennsylvania.—This company has secured a large tract of land in the northeastern part of the city of Philadelphia, Pa., which will be used for terminal facilities.

Hartford & Connecticut Western.—This road has been leased by the Central New England & Western R.R. Co., and will be operated together with its roads as a through line from Hartford, Conn., to Campbells' Hall, N. Y. The lessee assumes all responsibility for the extension from Tariffville, Conn., to Springfield, Mass.

Toledo, Ann Arbor & North Michigan.—The surveys for the proposed line from McBain Station to Lake City, Mich., are completed, and it is stated that work will commence at once.

Lime Rock.—This road, being built near Rockland, Me., to transport lime rock from the quarries to the kilns has been completed for a distance of 9 miles. About miles of the line are trestle work.

Projects and Surveys.

Phillips & Rangeley.—W. A. RICH, of Woodford, Me. sends us the following information:

B. F. CHADBOURN, of Gorham, Me., Civil Engineer has completed the preliminary survey for this road, which is projected to run from Phillips, via Madrid, Reddington, and Dallas, to Rangeley, Me., a distance of about 28 miles. It is expected that the road will do a large business in passengers, lumber and farm produce. A large part of the right-of-way has been secured and other local aid will be voted by the towns along the route. About ⅔ of the capital stock has been practically pledged. It is expected that the road will be opened for traffic some time in 1890. The road will be 3-ft. gauge, laid with 35-lb. steel rail. H. P. CLOSSEN, of Gardiner, Me., is President, and F. E. TIMBERLAKE, Clerk and Treasurer.

Keeseville, Ausable Chasm & Lake Champlain.—It is stated that sufficient stock has been secured to insure the construction of this road. The contract for the earthwork has been let to R. H. Rogers, of Plattsburg, N. Y., and for the bridge across the chasm to the Berlin Iron Bridge Co., of East Berlin, Conn. The bridge will be about 200 ft. in length and 123 ft. above the bed of the river. The road is projected to run from Port Kent to Keeseville, N. Y., a distance of 8½ miles. E. K. BARBER, of Keeseville, is President.

Kinderhook & Hudson.—Bids will be received up to August 17, for grading this road in sections of about

mile each. The road is projected to run from Kinderhook to Hudson, N. Y., a distance of about 16 miles. E. G. FERRIS, of Hudson, is Chief Engineer.

Delaware & North River.—The surveys are in progress for this road, which is to run from Summitville to Kingston, N. Y., about 40 miles. ISAAC N. COTT, of Ellenville, N. Y., is President.

Fort Plain, Johnstown & Saratoga.—The engineers of this proposed road have completed the surveys from Saratoga to Dolgeville. A very favorable route is reported. WM. CLARK, of Ft. Plain, N. Y., is interested.

Templeton Phosphate.—This company will apply to the Canadian Parliament for a charter to build a railway from East Templeton, P. Q., north about 15 miles. The headquarters of the company will be at Montreal.

Youghiogheny Connecting.—Incorporated in Pennsylvania to build a railway from McKeesport to Thomas Station, Pa., a distance of about 5 miles. RICHARD B. WOOD, of Allegheny City, is President.

Youghiogheny Southern.—Chartered in Pennsylvania to build a railway from a point on the Youghiogheny river near Broad Ford south-west to a point near Uniontown, Pa., a distance of about 20 miles. H. C. FRICK, of Pittsburg, is President.

Pittsburg & Mansfield.—This company has been incorporated to build a railway about five miles long in the city of Pittsburg, Pa.

Oneida, Oneonta & New York.—The directors of this road will hold a meeting soon to organize the company, after which it is stated work will be immediately commenced. The road is projected to run from Oneida, N. Y., to Oneonta, N. Y., a distance of about 75 miles.

Little Falls, Van Hornellsville & Otsego Lake.—S. E. BABCOCK, of Little Falls, N. Y., has made a preliminary survey for this road and is now at work upon plans and profiles. The road is projected to run from Little Falls to Springfield, N. Y., near Otsego Lake.

Rome & Carthage.—The survey for this proposed road has been completed. The road is projected to run from Rome to Carthage, N. Y., a distance of 56 miles. A. C. KESSINGER, of Rome, N. Y., is Secretary.

SOUTHERN.—Existing Roads.

Georgia Pacific.—There is a report that this company intends to build a branch road to Yazoo city, Miss., about 35 miles. On Aug. 9, the first through train was run from Atlanta, Ga., to Greenville, Miss.

East & West Alabama.—This company will extend its line from Cartersville, Ga., east to Gainesville, and thence to Athens, if the latter place will subscribe $35,000 for the purpose.

Atlantic & Danville.—Tracklaying has commenced on the division between Clarksville, Va., and Boydton, 7 miles.

Columbia, Newberry & Laurens.—The Edge Moor Bridge Co. has the contract for the bridge over the Broad river. It will cost $60,000.

Richmond & Danville.—Work has been suspended on the extension in North Carolina between Mocksville and Winston, the lattter place refusing to pay the $40,000 subscribed. Work will be begun between Mocksville and Salisbury immediately.

Eutawville.—The following is the present status of this enterprise: The road is projected to run from Charleston, S. C., to Cheraw, 160 miles, via Sumter. Contracts have been let from Charleston to Sumter, about 80 miles, Mr. Pringle, Summerville, S. C., doing the grading, and Mr. Pregnall, Charleston, S. C., the trestle work. About 200 men are now at work, 20 miles being wholly, and 8 partially graded. Track has been laid for 20 miles. Surveys are to begin at once from Sumter to Cheraw. Trains will probably be running to Sumter, Dec. 1, 1889. H. T. PEAKE, Sumter, S. C., is Chief Engineer.

Richmond, Nicholasville, Irvine, and Beattyville.—Monday, Aug. 12, bids were opened for the grading of this road between Richmond, Va., and Beattyville, Ky., 57 miles.

Nashville, Chattanooga & St. Louis.—The contractors for the shops of this company, now being built in Nashville, Tenn., are as follows: Foster & Creighton, grading; John Broderick, foundation walls, W. G. Bush & Co., brick work; I. W. Phillips, slating, iron, and tin work; Robertson Bros., wood work; Pittsburg Bridge Co., roof trusses, purlins, and skylights. Mr. EBEN PARDON is superintending the work.

East Tennessee, Virginia & Georgia.—The Tennessee courts have ordered the sale of this road if debts of $33,000, contracted before the road went into a receiver's hands, are not paid within 60 days. The case will be appealed.

Tennessee Midland.—The Virginia Construction Co. is about to begin grading from Perryville, Tenn., to which point track has been laid, to Nashville, 85 miles. When this extension is finished, through trains can be run from Memphis to Nashville, 221 miles.

Louisville, Hardinsburg & Western.—Corrigan & Tanzy have the contract to build 20 miles of this Kentucky road, which is to run from Lexington to Fordsville, 42 miles, and 5 miles are now graded, 200 men being at work. There is a large bridge and one tunnel on the line. CHAS. MCCRACKEN is Chief Engineer.

Chattaroi.—This Kentucky road, running from Ashland to Richardson, 50 miles, has been purchased at foreclosure sale by capitalists, who have incorporated the Ohio & Big Sandy R. R. Co., capital stock $2,000,000, to operate it.

Charleston, Cincinnati & Chicago.—A charter has been granted to this company in Tennessee to build a road from the North Carolina State line through Carter and Unicoi Counties, Tenn., to the Virginia State line near Mocassin Gap, about 35 miles.

Chattanooga, Rome & Columbus.—Columbus, Ga., has raised the subscription of $25,000 required to secure the extension of this road from Carrolton, Ga., south.

Georgia.—It is rumored that this company will build a road from Athens, Ga., to Chattanooga, Tenn., about 130 miles, via Gainesville, Kingston, and Rome.

Central R. R. of Ga.—Chief Engineer DARNEY is about to begin the survey for the extension of the Columbus & Rome R. R., from Greenville, the present terminus, to Newman, about 25 miles.

Augusta, Tallahassee & Gulf.—Work has begun on the railroad bridge across the Ocklocknee river near Tallahassee, Fla.

Savannah, Americus & Montgomery.—According to President HAWKINS of this company, an agreement has been made with the Central R. R. Co. of Ga., by which the former company will use the latter's tracks from Stirling, its eastern terminus, to Savannah, and the Savannah & Western trains will run over this company's tracks from Stirling to Americus. The agreement, however, does not preclude either company from extending its roads the entire distance whenever it so desires.

Dover & Statesboro.—Tracklaying will soon begin on this Georgia road, running from Dover to Statesboro, 10 miles. F. H. LOCKHART is president.

Darien Short Line.—The terminus of this road has been fixed at Belleville, Ga., instead of Darien, and the grading is now finished from Walthourville to that point, 30 miles.

Georgia Southern & Florida.—On the extension from Valdosta, Ga., to Palatka, Fla., via Lake City, 136 miles; 1,400 men are now at work, Joseph Marzyct has the contract for the trestles, E. B. Waters & Co., for the ties, Morgan & Reynolds, earthwork, Atlantic Bridge Co., the iron bridge over Allapahaw and Suwanee rivers. Already 40 miles of track have been laid, and trains are to be running Nov 15.

Rome & Decatur.—This road, now in operation from Rome, Ga., to Attalla, Ala., 62 miles, will be sold by foreclosure, Nov. 20, 1889, in the New York City real estate exchange. No bid will be received lower than $750,000, and 15 per cent. must be paid in cash.

Birmingham, Sheffield & Tennessee River.—Messrs. Fudge & Strang have the contract to build 36 miles of the extension from Jasper, Ala., to Birmingham, about 35 miles. There will be a tunnel 600 ft. long. The road is now in operation from Sheffield to Jasper, 90 miles.

Knoxville, Cumberland Gap & Louisville.—On Aug. 9 the headings met on the Cumberland Gap tunnel. It will be used jointly by this company and the Louisville & Nashville company. It is about one mile in length and is located at the intersection of the three States, Tennessee, Kentucky, and Virginia.

Chesapeake & Ohio.—This company will remove their machine shops and round houses from Huntington, W. Va., to St. Albans before long. It is also stated that a branch road will be built from St. Albans up Coal river.

West Virginia Central.—It is rumored that this road, now in operation from Cumberland to Elkins, W. Va., 112 miles, will build a branch to Rowlesburg to connect with the West Virginia & Pennsylvania R. R.

Projects and Surveys.

Bristol & Elizabethtown.—The city of Elizabethtown, Tenn., has voted $10,000 in aid of this road, which is projected to run from Bristol south to Elizabethtown, Tenn.

Gauley & Eastern.—Incorporated in West Virginia to build a railway from the mouth of Gauley river to Huntersville, W. Va. The object of the road is to open up the coal fields along the route.

Brunswick, Athens & Northwestern.—A bill has been introduced into the Georgia Legislature incorporating this company to build a railway from Brunswick, Ga., to Murphy, N. C., a distance of about 425 miles. Among the incorporators are: W. B. STILLWELL, C. B TOWNSEND, L. JOHNSON and others.

Ellerslie Northeastern.—A project is on foot to build a railway from Ellerslie, Ga., northeast to the Flint river, a distance of about 30 miles.

Knoxville, Newport, Greenville & Bristol.—This railway company has been organized in Tennessee.

Tropical Belt & Gulf.—Incorporated in Florida to build a line of railway from a point at or near Cleveland, Desota county, to a point at or near St. James City, Lee county, a distance of about 33 miles, with a branch from the main line north to a point near Fort Myers, Lee county, a distance of about 10 miles. Among the incorporators are: CHAS. F. TODD, J. D. CAMPBELL and JAS. M. KREAMER; all of Jacksonville, Fla.

NORTHWEST.—Existing Roads.

Northern Pacific & Manitoba.—Tracklaying on the Morris-Brandon extension has been completed for a distance of 35 miles, and is now being pushed at the rate of 2 miles per day.

Duluth Incline.—A correspondent informs us that 3 miles of track has been laid on this road since Jan. 1, 1889, of which 7,300 ft. is on an incline rising 600 ft. in that distance. This portion of the road is to be in operation by Sept. 1. The road is standard gauge with a maximum grade of 16 per cent., and will do both a freight and passenger traffic. Surveys are in progress for an extension to the Cloquet river, 15 miles, and it is expected that the road will be completed thus far this season.

Duluth & Winnipeg.—A press despatch from Duluth, Minn., states that the North Star Construction Co., organized to build this road, has made arrangements whereby the completion of the line to the Mississippi river, about 50 miles west, is assured. The road will strike the river at Itasca near Grand Rapids, Minn. Foley Bros. & Guthrie, of St. Paul, Minn., have the contract for building the road, and expect to have it completed by Dec. 10.

Jacksonville Southeastern.—It is announced that work on the extension from Litchfield, Ill., to St. Louis, Mo., will be commenced shortly, and the road be completed this season.

Louisville, Evansville & St. Louis.—Oliver Ferguson & Sons, who have the contract for building the line from Belleville to Mount Vernon, Ill., have sublet the contract to the following persons: Stewart & Co.; W. O. McLeod; Hayes Bros.; Jerry Hayes & Bro.; Ford & Wilkinson; Dresbach & Co.; Lynch & Williams; M. O'Leary; Donald & Jeffries & Co.; Haney, Evans & Co., and Hubbard & Co. The line is to be completed in 60 days. Work has already commenced.

Sioux City & Northern.—Work is now in progress on this road under the contractors E. P. Reynolds & Co. It is expected to have the grading completed by Sept. 1. The road is to run from Sioux City, Ia. to Palisades, Dak., 97 miles. J. E. TURNER, Sioux City, is Chief Engineer.

Milwaukee, Lake Shore & Western.—About 7 miles of track has been laid on the extension from Flambeau to Hurley, Wis., 40 miles.

St. Louis & Chicago.—A. G. KLEINBECK, of Litchfield, Ill., sends us the following information concerning the St. Louis & Peoria R. R.:

C. Porduskey, of St. Louis, Mo., who has the contract, has about 90 teams grading, and about 70 men grading and tracklaying. About 8 miles of track have been laid and the grading is completed on 4 miles more. The total length of the road from Mount Olive to Alhambra, Ill., is 14 miles. It is expected to have the line completed by Sept. 1. The road will do only a freight business at present.

Chicago, Milwaukee & St. Paul.—This company has filed an abandonment of its franchise to build a railway from Niobrara to Atkinson, Neb., with the Secretary of State. The franchise was granted some 8 years ago and preliminary surveys made, but nothing has been done since.

Projects and Surveys.

Escanaba & Crystal Falls.—It is announced that surveys will be made at once for a railway to run from Crystal Falls through the Menominee iron district, to Escanaba, a distance of about 90 miles. The object of the road is to obtain an independent line to the mines at Iron Mountain and Crystal Falls.

Oconto & Southwestern.—Incorporated in Wisconsin to build a railway from Oconto to Stiles, 10 miles. Among the incorporators are, GEO. BEYER, O. A. ELLIS, and others.

Flora & Sailor Springs.—The project is being agitated of building a railway from Flora, Ill., to Sailor Springs, a health resort about 14 miles northeast. It is thought that the line will be built this season.

Black Hills, Chamberlain, Huron & Duluth.—This company has been organized in Dakota to build a line of railway through the Sioux reservation.

Port Arthur, Duluth & Western.—It is stated that the contract for the construction of this road has been let and that work will begin at once. THOS. MARKS, of Port Arthur, Ont., is President.

Duluth, South Shore & Atlantic.—A press dispatch from Ishpeming, Mich., states that McIntosh Bros., contractors, have finished grading the extension from Hill Creek to Ontonagon and will begin laying steel next week. The extension is 46 miles in length.

Centerville, Moravia & Albia.—This road will soon be put into operation with the following officers: J. E. REDMON, Superintendent; E. S. BENSON, Auditor; SETH ZUG, Treasurer, and C. H. AKERT, General Manager. The road will be operated as a part of the Iowa Central System.

SOUTHWEST.—Existing Roads.

Marion Belt & Chingawasa Springs.—O. C. LE SUER, of Marion, Kan., sends us the following:

The line has been completed and opened for traffic from Marion to Chingawasa Springs, 8 miles. The maximum grade is 2 per cent. and maximum curve 18°. The object of the road is to open up the springs to tourists and to develop the quarries along the route. There is one

bridge 120 ft. long on the line. U. S. Woods, of Wichita, Kan., was the contractor.

Fort Worth & Rio Grande.—Track has been laid on this road from Granbury, Tex., south, 20 miles and grading is in progress from the end of track to Dublin, a distance of 30 miles. Surveys are in progress from Dublin to Comanche, Tex., 22 miles. There will be 6 large bridges between Granbury and Stephenville, Tex., 36 miles, designed to carry two 85-ton locomotives. Four of these are Pratt truss bridges of 130-ft., 110-ft., and two of 90-ft. span respectively; one lattice girder of 75-ft. span and one plate girder of 60-ft. span. The bridges are all supported on cylindrical iron piers filled with concrete The Chicago Forge & Bolt Co., has the contract for building these bridges. Work has commenced on the foundations of one bridge.

Kansas City, Wyandotte & Northwestern.—The citizens of Beatrice, Neb., have voted $50,000 of bonds, in aid of the Kansas City & Beatrice R. R.

Louisville, New Orleans & Texas.—E. K. HANNA, Civil Engineer, is making arrangements for commencing work on the incline at Helena, Ark. Contracts will be let soon for the work.

Missouri, Kansas & Texas.—This company has completed arrangements for trackage rights over the Houston & Texas Central R. R., from Elgin to Houston, Tex.

Southern Pacific.—The branch from Victoria to Beeville Tex., 55 miles, has been completed, and will soon be opened to traffic.

Atchison, Topeka & Santa Fé.—The *Denver Republican* is authority for the report that this company together with the Chicago, Rock Island & Pacific and the Denver, Texas & Forth Worth railway companies will build a line of railway from Washburn, Tex., southwest to El Paso. The plan is to have the Chicago, Rock Island & Pacific R. R., complete its line from Liberal, Kan., to Washburn, and the Denver, Texas & Fort Worth R. R., build from Panhandle City to Washburn and the three companies unite in extending the road westward. There is not much probability that the scheme will be carried out.

Projects and Surveys.

Kansas City & Suburban Belt.—E. L. MARTIN, of Kansas City, Mo., President, has furnished us the following information:

The intention is to build 20 miles of double track railway in Kansas City, Mo., and vacinity. Five miles of this distance will be completed this year. It will be an independent terminal line doing a transfer business for the various roads entering the city. Nearly all of the right of way has been secured, and all the stock and bonds subscribed. Contracts for construction will be let next week. It is expected that tracklaying will begin in about 3 weeks and the road opened for traffic early in the winter. J. W. HEYLMAN is Chief Engineer.

Brazos Terminal.—The surveys for this road have been completed from Vilasco to Arcola, a distance of 38 miles, and from Arcola to Houston, about 18 miles. It is stated that work will begin at once.

Pine Bluff & Sulphur Springs.—This company proposes to build a railway from Pine Bluff to Sulphur Springs, Ark., a distance of 7 miles. The road will ultimately be extended to Princeton, Ark., 38 miles.

ROCKY MT. AND PACIFIC.—Existing Roads.

Los Angeles, Pasadena & Glendale.—The contract for building this road has been let to Grant Bros., of Los Angeles, Cal., and work has already commenced. The contract requires that the road shall be completed ready for operation in 90 days. The road is projected to run from Los Angeles to Pasadena and Glendale. JOHN CROSS, of 27 West Second St., Los Angeles, Cal., is President.

San Francisco & North Pacific.—Lowry & Manigan, have the contract for grading and laying the cross-ties for the extension from Santa Rosa to Sebastopol, Cal., a distance of 6 miles. The work is to be completed by Oct. 1. The same firm also has the contract for widening the gauge of the line between Ignacio and Glen Ellen, and building a telegraph line between Cloverdale and Ukiah.

Fairhaven & Southern.—About 700 men are now at work on this line. The right-of-way from New Westminster south, has been secured and 50 miles of it cleared. Twenty miles of the road is graded south from Fairhaven, W. T., and 15 miles south from New Westminster, B. C. The iron for 30 miles of the road has been secured, and two 65-ton locomotives and 25 cars purchased. J. J. DONOVAN, of Fairhaven, W. T. is Chief Engineer.

Seattle & Northern.—A press dispatch states that work has been discontinued on this road. About 23 miles of the road has been graded east from Ship Harbor, W. T. It is thought that no more work will be done this year.

Carson & Colorado.—It is reported that this company will build an extension from Keeler, Cal., to a connection with the Utah Central R. R.

Santa Fé Southern—Surveys are now in progress for the proposed branch to the San Pedro mining camps.

Wyoming, Salt Lake & California.—Work is reported in progress between Park City, Utah, and the Wyoming State line. There will be a 1,000-ft. tunnel in Emigration cañon.

Projects and Surveys.

Tacoma & Silver Beach.—We have received the following information from L. U. LOOMIS, of Tacoma, W. T., Secretary:

The road is projected to run from Tacoma to Steilacoom, W. T., a distance of 9 miles. About 3 miles of the line has been surveyed. The country through which the road will pass, is generally level, affording easy grades and few curves. The principal business will be the local passenger traffic. Very little of the right-of-way has been secured; $25,000 bonus has been promised by Steilacoom. E. E. BAIR, of Tacoma, is President, and L. C. VICKREY, of Tacoma, Chief Engineer.

Road Canon.—Incorporated in Colorado to build a railway along Road canon with spurs to the various mining camps in the vicinity.

Portland & Puget Sound.—Incorporated in Oregon to build a railway from Portland, Ore., to Seattle, W. T., with branches to Gray's Harbor and Port Townsend W. T. Among the incorporators are: CHESTER W. COLLINS, JOHN D. KILPATRICK, JOHN H. SMITH, and others, of Portland.

FOREIGN.

Mexico.—A contract has been entered into between the department of public works and Mr. FRANCISCO ARTEAGA, for the construction of a line of railway from Matamoras Azular to the port of Acapulco.

Australia.—The Hampton Land & Railway Syndicate has made an application to the Western Australian Government for a concession to build a line of railway from York to Hampton Plains. It is thought that the concession will be granted.

RAPID TRANSIT.

Electric Railways.—*Lebanon, Pa.*—The Lebanon Electric Ry. Co. has been granted a franchise for a line 8 miles long. President, C. SHENK, of Lebanon; Secretary, C. M. MEILY, of Lebanon.

Nashville, Tenn.—The McGavock & Mt. Vernon Street Ry. Co. at its meeting on Aug. 9 approved the decision of the directors to equip all the lines for electric traction.

Knoxville, Tenn.—All the street railways in Knoxville, except the West Knoxville lines, 12 miles in all, have been purchased by W. G. MCADOO, Jr., of Chattanooga, who, it is said, represents Chattanooga and Philadelphia capitalists. A new company was at once organized and Mr. MCADOO was elected President. The price paid was about $500,000. Electric cars will be substituted for horse cars at once.

Columbus, O.—The Columbus Consolidated Street Ry. Co proposes to adopt the Thomson-Houston system of electric traction.

Bloomington, Ill.—The Bloomington and Normal street railway is being equipped for electric traction.

St. Louis, Mo.—The Union Depot and Mound City railway companies have decided to increase their capital stock and to adopt electric traction.——The St. Louis & East St. Louis Electric Ry. Co. will build a double track line 3½ miles long, crossing the bridge. The cars are being made by the Brownell & Wight Car Co., the iron poles by the Shickle, Harrison & Howard Iron Co., the engines by E. L. Ide, of Springfield, Ill., and the boilers by J. Wangler. Capital stock, $100,000. C. E. CARROLL, D. R. POWELL and E. C. LACKLAND are interested.

Kansas City, Mo.—The Metropolitan Street Ry. Co., has decided to adopt electric traction for its Broadway line.

Portland, Ore.—The Woodstock & Waverly line is to be equipped with the Thomson-Houston system. The line will be 6¼ miles long.

Sherman, Tex.—The College Park Electric Ry. Co. has been incorporated with a capital stock of $100,000.

Street Railways.—*Pittsburg, Pa.*—The Bloomfield & Shady Side Ry. Co. has been incorporated by H. S. A. STEWART, JOHN G. HOLMES, GEO. C. WILSON and others. Capital stock, $30,000. The Forbes St. & Park Ave. Passenger Ry. Co., $12,000; the Wilkins Ave. Ry. Co., $12,000; the Homewood Ave. Ry. Co., $12,000; the Frankstown Ry. Co., $30,000, and the Forbes St. & Shady Ave. Ry. Co., $12,000, have also been incorporated. H. S. A. STEWART is interested in all these companies.

Lancaster, Pa.—The Lancaster Street Ry. Co. has awarded the contract for constructing its road to T. Wm. Harris & Co., of New York.

Martin's Ferry, O.—The Wheeling Ry. Co. has been granted a franchise for a street railway; the line will cross the new bridge to Wheeling.

South Bend, Ind.—The South Bend & Mishawaka street railway, and the plant and franchises of the company, will be sold at auction at the U. S. Post Office building, Indianapolis, Ind., on Sept. 10.

Davenport, Ia.—The Davenport Electric Street Ry. Co. has been incorporated.

Paola, Kan.—The Paola Street Ry. Co. has been incorporated by A. LOHMAN, LOUIS KIEFER and WM. B. BRAGMAN, of Paola; JULIUS HEROLD and A. H. LEWIS, of Kansas City, Mo., and THOMAS SHORT, of Detroit. Capitol stock, $500,000.

Dummy Line.—*Montgomery, Ala.*—The Montgomery Terminal & Street Ry. Co., has been authorized to build standard gauge extension of its lines and to haul freight cars by dummy engines.

Cable Railways.—*Detroit Mich.*—A franchise for a cable railway has been applied for by HENRY T. THURBER, ALBERT IVES, Jr., S. B. SINCLAIR and FRANK X CICOTTE. It is to be a double track road, 3 ft. 6 ins gauge, and will cost about $500,000.

Los Angeles, Cal.—The Los Angeles Cable Ry. Co. opened its 1st St. and Boyle Heights line on Aug. 3. There are 2 engines, and steam is supplied by 2 Hazelton boilers fitted with mechanical stokers. The cable is 22,500 ft. long.

HIGHWAYS.

Highways and Bridges.—Bids will be received up to two (2) o'clock P. M. Monday, Sept. 20, 1889, by the Board of Road Superintendents of Escambia county, Fla., to put and keep in good condition the roads and bridges of this county.

The first or southern district has ninety (90) miles of road and 2,600 ft. of bridges.

The second or Molino district has forty-five (45) miles of road and 324 ft. of bridges.

The third or Bluff Springs district has one hundred and twenty (120) miles of road and 1,230 ft. of bridges.

Specifications can be seen for the first district by applying to Geo. R. Smith, Pensacola; for the second district by applying to J. R. Fillimgin, Molino; for the third district by applying to W. B. Hubbird, Wilson Station, Ala.

Section 5 of the road laws reads:

"Section 5. The working, making altering, repairing, fixing, and constructing of the public roads and bridges shall be let out on contract to the lowest bona fide bidder, by districts for the period of one year; said contract shall contain specifications as to the location, class, nature, and necessary amount of work performed in said district during the year for which the contract is let, and the contractor shall give a good and sufficient bond in double the amount of such bid when accepted, with two or more sureties to faithfully work, make, alter, repair, fix or construct any and all public roads and bridges in the district of which the contractor agreed to take."

The Board reserves the right to reject any or all bids.

W. B. HUBBIRD, J. R. FILLIMGIN, GEO. R. SMITH.

The Best Street Paving.—An article on "Roads and Road-making," with special reference to the needs of New York, by Captain F. V. GREENE, is published, together with 26 illustrations, in *Harper's Weekly*, Aug. 7.

Village Roads.—The citizens of New Rochelle, N. Y., have petitioned the Board of Village Trustees to raise $6,000 by tax to improve the roads of the village.

CONTRACTING.

Filling.—Proposals for filling the Francis flats on the Charles river have been received by WM. H. WHITNEY, C. E., Boston, Mass.: Ground No. 1; Massachusetts Dredging Co., 19¾ and 23½ cts, per cu. yd. in the dump; Boynton Bros., 20, 30, and 48 cts. in the dump, 18 28, and 46 cts. in the scow; P. J. Brummelkamp, 40 cts. in the dump, 25 cts. in the scow. Ground No. 2: Boynton Bros., 22, 32, and 50 cts. in the dump. 20, 30, and 48 cts. in the scow; P. J. Brummelkamp, 40 cts. in the dump, 25 cts. in the scow.

Sewers.—*Albany, N. Y.*—The contract for drains in Central Ave. has been awarded to Patrick Murray, as follows: $2.85 per lin. ft. for 20-in. pipe, $2.39 for 18 in., $2.35 for 15-in., 49 cts. for 6 in., $8 49 each for 20-in. Ys, $6.73 for 18-in., $5.89 for 15-in., $65 each for manholes, $79 each for receiving basins.

Phillipsburg, N. J.—The following proposals have been received by the Sewer Committee for 1,000 ft. of 30 x 45 ins. brick sewer, 275 ft. of 20-in. vitrified pipe, etc.: S. B. Mutchler, Phillipsburg: $4 60 per lin. ft. for brick sewer, $1.45 for 20-in. pipe, $2.75 per vertical foot for manholes, $45 each for inlets, $95 each for basins, 70 cts. and $1 for 9 and 12-in. pipe, 4 cts. per lb. for castings, total $6,484. D. W. Hagerty, Phillipsburg: $5.50 for brick, $1.85 for pipe, $25 for manholes complete, $40 for inlets. $160 for basins, $1.25 and $1.50 for pipe, 4½ cts. for castings, 50 cts. per cu. yd. for rock excavation, total $7,585.75.

Newark, N. J.—The following proposals have been received for 870 ft. of 12-in. pipe 4 manholes and 1 basin, on North 9th St.: Satchwell & Bellingham, $1.35, $40, $110; James Maguire, $1.60, $45, $115; Hughes & Flynn, $1.75, $40, $120.

Dubuque, Ia.—The contract for sewerage has been awarded by Mr. TSCHIRGI, City Engineer, to Reilly & Forrestal, of St. Paul, Minn., at 90 cts. per ft. for 15-in. pipe, 73 cts. for 12 in., 69½ cts. for 10-in. and 55½ cts. for 8-in.: $29 for manholes; total, $17,046.67. The other bidders were: Rockford Const. Co., Rockford, Ill., $20,523.40; Irwin & Maher, $21,088.95, $52 for flush tanks; J. Gleason & Son, $24,040.65, $40,50 for flush tanks; Thos. Finn, $24,743,25, $35 for flush tanks; J. C. Murray, Dubuque, $23,331.45; E. T. Sykes, $24,417.35, $85 for flush tanks; D. W. Linehan, Dubuque, incomplete, $32 for flush tanks; P. T. Gutberie, Dubuque, incomplete.

Kansas City, Kan.—The contract for building a sewer extension in District No. 2 has been awarded to R. O. Mooney at $18.42 per lin. ft.

Little Rock, Ark.—The following proposals have been received by F. J. H. RICKON, City Engineer, for work in sewer district No. 10, including 2,925 lin. ft. of 8-in. tile, 275 ft. of 6-in. tile, 3 flush tanks, 4 manholes and 16 lamp holes, average cut 8½ ft.; Arkansas Pump & Pipe Co., $2,275 (accepted); W. H. Wordswell, $2,340; N. Pray & Co., $2,350; R. Webster, $2,775.

Sand, Cement, and Timber.—The following proposals have been received by the Docks Commissioners, New York City: For 350 cu. yds. of sand: Brown & Fleming, 85 cts. per cu. yd.; John A. Bouker, 90 cts.; contract awarded to Brown & Fleming. For 500 bbls. of Portland

Dikes.—The following proposals for repairing dikes in the Hudson river, between New Baltimore and Troy, N. Y., were opened Aug. 6 by Lieut.-Col. G. L. GILLESPIE, U. S. Engineer Office, New York City.

Bidders	10,000 lin. ft. of pine or spruce piles		210 lin. ft. of white oak piles		14,500 ft. B. M. square timber, yellow pine		5,000 ft. B. M. sheet piling, yellow pine		4,150 lbs. iron tie rods and screw bolts		1,150 lbs. drift bolts, washers, etc.		300 cu. yds. quarry spalls or gravel		1,000 sq. yds. stone paving		17,200 cu. yds. ordinary rubble stone furnished by bidder		17,200 cu. yds. ordinary rubble stone furnished by U. S.		22,450 cu. yds. large stone furnished by bidder.		22,470 cu. yds. large stone furnished by U. S.		1,000 cu. yds. dredging		Tot l amount stone furnished, by bidder	Total amount stone furnished, by United States
	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Am't	Am't
	$	$	c.	$	$	$	$	$	c.	$	c.	$	$	$	$	$	$	$	$	$	$	$	$	$	c.	$	$	$
John A. Bouker	15	1,500.	30	63.	38	551.	40	200.	7	290.50	6	69.	1.40	280	1.	1,000	1.48	25,456	1.38	23,736	1.48	33,226.	1.35	30,981.	90	900	63,625.50	59,660.50
John Kelly	15	1,500.	27	56. 04	43	623.50	43	215.	4	166.	6	69.	1.	300	2.38	2,380	1.65	18,060	1.10	18,920	1.30	29,185.	1.35	30 307.50	85	850	58,395.29	55,377.70
Brown & Fleming	20	2,120.	30	63.	45	652.50	45	225.	5	207.50	5	57.50	1.25	250	2.25	2,250	1.45	24,080	1.40	24,080	1.40	31,430.	1.40	31,430.	20	200	61,535.50	61,535.50
Wm. D. Fuller	11⅞	1,258.75	23	48.30	39	565.50	45	225.	5	207.50	3¾	43.13	.98	196	1.60	1,600	.97	16,684	3.	51,600	3.98	89,351.	5.	112 250.60	1.00	1,000	111,179.18	108,994.18
Charles C. Cotte	25	2,650.	30	63.	85	1,232.50	45	225.	6	249.	5	57.50	1.50	300	3.	3,000	1.50	25,800	1.50	25,800	1.70	38,165.	1.70	38,165.	50	500	72,242.	72,242.
L. A. Marshall	28	2,968.	50	105.	54	783.	54	270.	10	415.06	10	115.	2.	400	2.50	2,500	1.75	30,100	1.75	30,100	1.75	39,287.50	1.75	39,287.50	35	350	77,293.50	77,293.50
Francis H. Smith	20	3,180.	35	73.50	55	797.50	55	275 00	8	332	8	92.	1.65	330	1.90	1,900	1 50	27,348	....	.....	1.50	35,605.50	....	.. ..	30	300	70,323.50	

cement: Haibler & Co., $2,31¼ per bbl.; James Brand, $2.32; Dickinson Bros. & King, $2.38; Marcial & Co., $2,40; Sinclair & Babson, $2.55; E. W. Fisher, $2.55. The contract was awarded to Haibler & Co. A contract for white oak was awarded to Vanderbilt & Hopkins at $60 per 1,000 ft. B. M.

Dams.—The following proposals for cofferdam, excavation, and construction of abutment for dam No. 1, Cumberland river, near Nashville, were opened Aug. 6, by Lieut.-Col. J. W. BARLOW, U. S. Engineers, Nashville, Tenn.: John G. Eigenman, of Rockport, Ind., and A. Wallenbach, of Cannelton, Ind.: $5 per cu. yd. for 40 cu. yds. of rock excavation, 75 cts. for 700 cu. yds. of earth excavation, $10 for 500 cu. yds. of backing masonry, $12 for 350 cu. yds. of rock face masonry, $13 for 300 cu. yds. of cu. yds. of pointed face masonry; total, $13,825. Holmes & Wilk, of Nashville: $1.25 and 30 cts. for excavation, $7.50, $10 and $11 for masonry; total, $10,180.

Sewer.—The following proposals for the construction of Stacy's brook sewer, at Lynn, Mass., were opened July 31 by the City Engineer. The contract was awarded to James E. Manning.

	John F. Heath, Lynn		James Heath, Lynn		H. H. Pike, Boston.		James E. Manning, Lynn.		George Jepson Boston.	
	Price	Total	Price	Total	Price	Total	Price	Total	Price	Total
7,510 cu. yds. earth excav. and filling, for trench	.75	$ 5,632.50	.85	$ 6,383.50	.80	$ 6,008	.82	$ 6,158.20	1.00	$ 7,510
20 cu. yds. earth excav. and filling not for trench	.50	10	.45	9	.50	10	.50	10	.50	10
125 cu. yds. rock excavation	4 65	581.25	5.10	637.50	3	375	7	875	3.50	437.50
50 " concrete	6	300	5	250	6	300	5.50	275	4.50	225
956 " brick masonry, Am. cemt. mortar	12	11,472	12.25	11,711	13	12,428	13.50	12,906	13	12,428
90 cu. yds. brick mas. Portland cem. mor	14	1,260	14.50	1,305	15	1,350	17	1,530	15	1,350
10 " rubble stone masonry	3	30	2.50	25	7	70	5.40	54	5	50
50 sq. ft. flag stone masonry	1.10	55	.90	45	1	50	.75	37.50	2	100
3,000 lin. ft. of 8-in. drain pipe, laid	.45	1,350	.42	1,260	.50	1,500	.32	960	.40	1,200
Scratch basins, complete	65.00	520	67	536	75	600	72	576	25	200
300 lin. ft. of 8 in. connection pipe, laid	.65	195	.70	210	.60	180	.55	165	.50	150
240 8-in. slants, in place	.42	100.80	.40	96	.40	96	.45	108	.50	120
1 flume and inlet chamber, complete	200	200	200	200	250	250	75	75	75	75
1,000 ft. B. M spruce lumber, in place	20	20	25	25	34	30	30	30	28	28
		21,776 55		22,093		23,247		23,759.70		23,883.50

Gas Pipe.—The Trustees of the Gas Works, Hamilton, O., have awarded a contract to the Addyston Pipe & Steel Co., of Cincinnati, at $25.75 per ton for 318 tons of 12-in., $26 75 for 378 tons of 8-in., and 197 tons of 6-in., $28.75 for 1,004 tons of 4-in.; 2.4 cts. per lb. for 30 tons of castings.

Lighthouse. — The Secretary of the Treasury has awarded the contract for the construction of a double lighthouse keeper's dwelling, fog signal building, etc., for Point San Luis, Cal., light station, to Geo. W. Kenney, of Santa Barbara, at $18,893.

Street Work.—*Eau Claire, Wis.*—The following proposals have been received by C. E. BUSSELL, City Engineer, for 38,247 sq. yds. of cedar block paving, 7,840 ft. of Joliet limestone curbing, and 7,900 ft. of wooden curbing: Thomas Reilly, St. Paul, $40,242,95; Eau Claire Plumbing & Construction Co., $40,542,04; J. B. Smith & Co., Chicago, $41,070.58; D. A. Thatcher, Chicago, $41,232; England & Thomas, Eau Claire, $43,344 31; McAdams & Amberg, Chicago, $43,862.61; Hurley Bros., Bay City, Mich., $43,952.35; Loper, Wells & Co., Omaha, Neb., $44,013,71; McCann & Ellis, Eau Claire, $47,458.66; John Davis, Saginaw, Mich., $51,367.70. The contract was awarded to Thomas Reilly.

Seattle, Wash.—Contracts have been awarded at 32 and 35 cts. for earth excavation, $17 50 per M. for sidewalks and curbs, $85 and $100 per acre for grubbing 17 cts. for piling.

PROPOSALS OPEN.

Street Work.—Grading curbing, and graveling. DONN M. ROBERTS, City Engineer, Terre Haute, Ind. August 20.

Bridge.—Over Cherry creek, at Larimer St. Highway bridge, with cable railway tracks; 3 trusses, 74 ft. apart c to c., 2 roadways and 2 sidewalks 10 ft. wide. To be built according to THEODORE COOPER'S specifications. F. B. CROCKER, President Board of Public Works, Denver, Col. August 20.

Excavation.—Removal of the foundations of the former reservoir on Beacon Hill, and excavating the lot to a certain grade. THE STATE HOUSE COMMISSIONERS, 27 Mt. Vernon St., Boston, Mass. August 22.

Paving.—About 2,350 sq. yds. of cobble stone and 1,750 sq. yds. of trap rock paving. ERNEST ADAM, City Surveyor, Newark, N. J. August 22.

Street Work.—Regulating and granite block paving. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York City. August 22.

Supplies.—At the Navy Yard, Brooklyn, N. Y., 650 bbls. Portland cement, 550 cu. yds. broken stone, 100 cu. yds. sand, 40 white oak piles, 630 spruce piles, and 250,000 ft. yellow pine timber. JAMES FULTON, Pay master General U. S. N., Navy Department, Washington, D. C. August 22.

Street Work.—Grading, draining, and brick paving. WALTER P. RICE, City Engineer, Cleveland, O. August 22.

Levee.—Paving 600 sq. yds. of levee at Shawneetown, Ill. Lieut LANSING H. BEACH, U. S. Engineer Office, Cincinnati, O. August 24.

Sewers.—JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. August 26.

Pumping Station.—High level pumping station. Architect, J. A. FOWLER, 13 Victoria St. JAMES BOUSTEAD, Chairman, Committee on Water-Works, Toronto, Ont., Canada. August 26.

Water-Works.—For Ripon, Wis. Supply from filter gallery. Pipe, hydrants, stand-pipe, pumping engines, etc., required. (See advertisement.) Consulting Engineer, W. F. GOODHUE, Milwaukee. H. C. EVERSZ, Mayor, Ripon, Wis. August 26.

Filling.—About 200,000 or 400,000 cu. yds. at the Marine park, South Boston. Plans and specifications at the office of the City Engineer. THE PARK COMMISSIONERS, 87 Milk St., Boston, Mass. August 30.

Bridge.—Iron bridge, 164 ft. span, 16 ft. roadway, 2,000 lbs. capacity. Specifications on file. JOHN LILLY, Auditor's Office, Mankato, Minn. September 1.

Court House and Jail.—Plans, specifications, details, and proposals. Steel cells furnished by the county. W. R. FORREST, County Auditor, Seattle, W. T. September 3.

Machine Tools.—For the equipment of a gun factory. Col. J. M. WHITTEMORE, U. S. A., Watervliet Arsenal, West Troy, N. Y. September 5.

Roads and Bridges.—Repairing and maintaining roads and bridges: 1st district, 90 miles of road and 2,600 ft. of bridges; 2d district, 45 miles of road and 324 ft. of bridges; 3d district, 120 miles of road and 1,230 miles of bridges. THE BOARD OF ROAD SUPERINTENDENTS, Pensacola, Escambia Co., Fla. September 20.

Bridge.—Across the Madison river, near Red Bluff. JOS. SMITH, Virginia City, Mont. September 23.

MANUFACTURING AND TECHNICAL.

The Granite Sidewalk & Vitrified Block Paving Co., for the manufacture of granite and other artificial stone sidewalks and cement work of all kinds, together with the manufacture of Lumbye's patent compound and vitrified block pavement in New York, has been incorporated by JAMES N. WOOL, GEORGE M. WOOL and HANS LUMBYE. Capital stock, $10,000.

Hand Cars.—The Kalamazoo Railway Velocipede Co. has an order for 20 hand cars of metre gauge for Cuba.

Steel Works.—The Chicago & Calumet Rolling Mill Co. has been incorporated at Chicago, Ill., with a capital stock of $1,000,000.

The Seattle Iron & Steel Mfg. Co. has been incorporated at Seattle, W. T., by WM. HAINSWORTH, WM. H. HAINSWORTH, LEIGH S. J. HUNT, W. C. HILL, THOMAS EWING, WILLIAM E. BAILEY, BAILEY GATZERT, JOHN W. EMERSON, LYMAN ELMORE, T. A. NOBLE and ROBERT H. BOYLE. Capital stock, $100,000.

Construction Companies.—The Savannah Construction Co. has been organized at Savannah, Ga., by CHARLES WATKINS, of Richmond, Va.; JOHN LAWTON, of Hampton county, S. C.; MIKE BROWN, of Barnwell, S. C.; JOHN L. HAMMOND, HERMAN MYERS, WILLIAM S. TISON, THOMAS F. STUBBS and B. A. DENMARK, of Savannah, Ga. Capital stock, $250,000.

The Chicago & Arkansas Railway Construction Co., of Chicago; for building railway telegraph lines and bridges and supplying the necessary equipments for the same; capital stock, $325,000; incorporators, GEORGE M. BARBOUR, ADOLPH CUDELL, and F. C. RUTAS.

Track Laying.—The Railway Track-Cleaner Mfg. Co. has been incorporated at Minneapolis, Minn., by HENRY KRYGER, T. S. CONNEY, and others, to build machines for cleaning away snow, etc., under H. KRYGER'S patents. Capital stock, $500,000.

Filter.—The Pasteur-Chamberland Filter Co., of Dayton, O., is sole licensee for the United States and Canada, for the Pasteur filter for domestic purposes. It consists of two chambers and one or more hollow porcelain tubes having no opening except an orifice at one end through which the purified water is discharged. No impurities penetrate this material, but are arrested on the outside where they can readily be removed. These tubes are imported from France, where alone the material is found of which they are made. They can be cleaned in a few minutes.

The Westinghouse Air Brake Co., of Pittsburg, Pa. has issued a pamphlet and price list referring to matters connected with the brake question and showing the reduced prices that went into effect Aug. 1.

Cement. — ERSKINE W. FISHER, of New York, has made arrangements for the entire control in this country and Canada of the "Sphinx" Portland cement, manufactured in France, and has issued a circular giving particulars of some tests made.

The Porter Mfg Co., of Syracuse, N. Y., is building 5 or 6 stand-pipes for water-works. The company reports its boiler business good and its engine and stone crusher business fair.

The Pond Engineering Co., of St. Louis, Mo., reports several orders for Armington & Sims engines, boilers, etc. An oil filter has been sold to the Pine Bluff, Ark.,

Water & Light Co. The sales of books on engineering topics have been large.

Iron Work.—McKinney & Son, of Albany, N. Y., have the contract for iron work for the new Delaware & Hudson station at Scranton. The contract is for about $13,000.

The Watson Contracting Co., of East St. Louis, Ill., has been incorporated by C. W. WATSON and JOSEPH FREIS.

Signals. — The Railway Automatic Danger Signal Co., of Chicago, has been incorporated for the construction and sale of automatic danger signals for railways, etc. Capital stock $250,000. Incorporators, JAMES W. STEELE, N. C. GRIDLEY, and D. H. FLETCHER.

The Birkinbine Engineering & Supply Co. has been organized at Omaha, Neb., to deal in all kinds of engineers' and contractors' supplies.

Car Wheels.—The Dickerson Car Wheel Co., of Houston, Tex., has an order for two carloads of wheels for the Denver & Ft. Worth Ry.

Cross Ties.—Information is wanted as to the prices of railway ties of different kinds of wood in all sections of the country. Engineers, lumber dealers, etc., are invited to send in particulars to E. E. R. TRATMAN, at this office.

Locomotives.—The Baldwin Locomotive Works, of Philadelphia, Pa., have shipped a large dummy engine to the Hawthorne Ave. Ry. Co., at Portland, Ore.

The Rogers Locomotive Works, of Paterson, N. J., are building 3 engines, with cylinders 17 x 24 ins., for the San Francisco & North Pacific.

Cars.—The St. Charles Car Co., of St. Charles, Mo., is building several passenger cars for the Denver & Rio Grande.

The Harrisburg Car Works, of Harrisburg, Pa., are building 200 cars for the Pennsylvania, and 700 cars for other roads.

The Pullman Palace Car Co., of Chicago, Ill., has built 25 flat cars for the Astoria & South Coast road, in Oregon, and will build 200 more.

Dyott & Co., of New York, have an order for 100 flat cars for a railway in Cuba.

The Pennsylvania road has been receiving proposals for the construction of 5,000 freight cars.

The American Car Equipment Co., of New York, has purchased the old cars of the Broadway & 7th Ave street railway.

Machinery.—The entire plant of machine tools and appliances of the Hinkley Locomotive Works, at 439 Albany St., Boston, Mass., will be sold at auction Aug. 21 by Hill, Clarke & Co., 156 Oliver St., Boston. The plant includes 101 lathes, 61 planers, 25 upright drills, 11 wall and radial drills, 9 slotters, 3 shapers, 7 boring machines, 14 bolt and nut machines and many special machines; also complete outfits for forge, boiler and tinshop.

The Citizens' Street Railway Co., Pine Bluff, Ark., wants bids (long tons) on about 2 miles of first-class second-hand iron or steel T rails, 25, 30 or 35 lbs. per yd.

A second-hand engine, modern, 75 to 100 H. P., is wanted. Address, A 62, *Globe Democrat*, St. Louis, Mo.

W. J. CARLIN, Weddell House, Cleveland, O., wants to purchase 5 friction drum hoisting engines, double drums preferred; two 3-ft. gauge light saddle tank locomotives; one heavy shear. State where to be seen, condition, make, and price.

Rock Breakers.—In *Harper's Weekly*, New York, of Aug. 10th, is a well written illustrated article by Capt. FRANCIS V. GREENE on "Roads and Road-Making." Among the illustrations are views of the rock breaker manufactured by the Farrel Foundry & Machine Co., of Ansonia, Conn. This machine is claimed to be an improvement upon what was known originally as the "Blake" rock and ore breaker, and is especially adapted for road-making purposes, as it will break stone to any size desired. Capt. GREENE describes it briefly as follows: "It consists essentially of a strong iron frame, near one end of which is a movable jaw of iron. By means of a toggle joint and an eccentric, this jaw is moved back and forward a slight distance from the frame. As the jaw recedes, the opening increases and the stone descends; as it approaches the frame the stone is crushed. These machines are driven by steam engines and are of various sizes, capable of crushing from 10 to 200 tons per day. By regulating the width of opening between the jaws, the size to which the stone can be broken is correspondingly regulated, and by the use of revolving screens, with openings of various sizes, the stones of different sizes can be separated and delivered in separate piles."

BRIDGES AND CANALS.

Bay of Quinte Bridge.—The bridge across the bay to connect Belleville, Ont., with Prince Edward county is now under construction. The total length of bridge and approaches is 5,600 ft., steel superstructure with masonry piers, and abutments 1,910 ft. in length. It is a low level bridge with 16 fixed spans and 1 draw span in the steamer channel 240 ft. over all, giving 2 openings of a little over 100 ft. each. C. H. KEEFER, of Toronto, is the engineer.

Bridge Notes.—*Newark, N. J.*—The Essex Co. Board of Freeholders has decided to issue bonds for an amount not exceeding $45,000 for repairing and rebuilding the bridges and culverts destroyed or injured by the recent floods.

Rutherford, N. J.—The Joint Committee of the Board of Freeholders of Bergen and Passaic counties, New Jersey, met Aug. 10, at the office of Wise & Watson, Civil Engineers, in Passaic, and awarded the contract for the construction of an iron bridge over the Passaic river at Rutherford. The contract for the construction of the foundations was awarded to J. W. Stagg, of Englewood, N. J., his bid of $7,994 having been the lowest. The Groton Bridge & Mfg. Co. of Groton, N. Y., was given the contract for the superstructure at $6,290. The work consists of 2 abutments, 3 piers and 2 fenders, and 3 spans of wrought iron triangular truss bridge of 100 ft. each.

Hackensack, N. J.—The New York, Lake Erie & Western Ry. is building a new draw over the Hackensack river on the Newark branch. It is 140 ft. long, and will cost about $75,000. M. Brown, of Paterson, is the contractor.

Fredericksburg, Va. — A committee of the City Council and the county committee have been discussing the erection of a bridge at Scott's bridge site.

Washington, D. C.—A bridge is proposed across the Eastern branch at the foot of So. Capitol St. A. K. BROWN and A. MOFFIT are interested. A new road will be built from the bridge to Fort Washington.

Cleveland, O. — The County Commissioners opened proposals on Aug. 7 for building a bridge over Rocky river at Detroit St. The bids for the superstructure were as follows: Youngstown Bridge Co., $44,300; Mt. Vernon Bridge Co., $41,456; Keystone Bridge Co., Pittsburg, $44,950; Columbus Bridge Co., $47,950; Variety Iron Works Co., $42,004 50; King Iron Bridge & Mfg. Co., $39,950. A bid of $21,42[illegible].80 from J. A. Fisher, of Windham, was the lowest for the substructure. Together these bids aggregate $61 374 80, which is over $6,000 above the appropriation for the bridge.

Meridian, Wis.—The County Board has received plans, specifications, and an estimate for an iron bridge over the Chippewa river. The erection of the bridge will be decided upon at the meeting of the Board in November.

St. Joseph, Wis.—A county bridge is projected. For particulars address RICHARD BAKER.

Sacred Heart, Minn.—An iron bridge is proposed across the Minnesota river between Renville and Redwood counties.

Rockwood, Minn.—The following bridges are to be built. One combination bridge 48 ft. clear span, 14 ft. roadway, 8,000 lbs. capacity; 2 iron bridges 24 ft. clear span. Address JOHN BARBER, Wadena, Minn.

Texarkana, Ark.—The contract for the Texarkana & Fort Smith Ry. bridge over the Red river has been awarded to the Missouri Bridge Co., of St. Louis, Mo.

Denver, Col.—The Board of Public Works will advertise for proposals for removing the old Larimer St. bridge and abutments at Cleary creek, and for the construction of new abutments and a new iron bridge over the creek.

Deer Lodge, Mont.—Address MORGAN EVANS, Chairman of County Commissioners, in regard to new bridge work.

Toronto, Ont.—The City Engineer has presented plans and estimates for new bridges as follows: Dundas St. bridge, $81,000 and $75,000, including bridge, grading, land, etc. College St. bridge, $38,000.

Lethbridge, N. W. T.—The contract for the Belly river bridge has been awarded to E. Whiddee, contractor at $24,800.

Two drawbridges on the line of the Chicago & Northwestern Ry. have been let to Shailer & Schnigiau, of Chicago.

ELECTRICAL.

Electric Lighting.—*Somerville, Mass.*—A contract has been made with the Somerville Electric Light Co.

Windsor Locks, Conn.—HENRY C. DOUGLASS is corresponding with a New York firm regarding the putting in of an electric light plant. The cost of erecting the plant is estimated by this firm to be $12,000 to $15,000, and probably 1,000 lights would be used. The firm will take 25 per cent. of the stock, providing $3,000 can be raised by the citizens of the town, and will take a mortgage on the remainder of the stock.

Warsaw, N. Y.—The Committee on Electric Light has recommended the adoption of the Thomson-Houston system.

New York, N. Y.—The Safety Light & Power Co. has commenced the erection of its extensive station. It will operate the Westinghouse alternating system, and has contracted for six Westinghouse compound engines, of 150 H. P. each.

Allegheny, Pa.—The Brilliant Electric Light Co. has been incorporated, and will bid for lighting the streets, parks and buildings. The incorporators are R. T. MCDONALD, A. H. HEISEY, WILLIS F. MCCOOK, EUGENE INGOLD, A. E. TOWNSEND, and JAMES C. MILLER, of Pittsburg and Allegheny.

Washington, D. C.—The contract for electric light for the navy yard has been awarded to the Brush Electric Light Co., of Cleveland, O., at $13,975.

Roanoke, Va.—The plant of the Edison Electric Light Co. has been put in operation.

Abingdon, Va.—The contract for an electric light plant in connection with the water-works has been let to the Edison Electric Co., of New York.

Grafton, W. Va.—The Grafton Gas & Electric Light Co. has been organized by GEO. BRINKMAN, LEONARD MALLONEE, and others. Capital stock, $50,000.

Sumter, S. C.—The Sumter Electric Light Co. has made a contract with the city for 25 arc lights, and has contracted with the D. A. Tompkins Co., of Charlotte, N. C., the Southern agents of the Westinghouse Co., for an electric and steam plant to be installed and ready to turn on the lights by Oct. 25. The plant will have a capacity of 35 arc lights of 2,000 c. p. each, and 500 incandescent lights of 16 c. p. each. A lot upon which to erect the necessary buildings has been purchased, and they will be put up at once. The system of arc lights used will be the Waterhouse, and the incandescent lights will be of the Westinghouse system.

Bay City, Mich.—The Bay County Electric Light Co. has made a contract for plant with the Keystone Construction Co., of Pittsburg, Pa.

Detroit, Mich.—The Commercial Electric Co. has applied for a franchise. President, JOSEPH B. MOORE; Manager, WM. H. FITZGERALD.

Tuscola, Ill.—An electric light system is projected in connection with the proposed water-works.

Galena, Ill.—The contract with the electric light company is said to have been annulled by the council on the ground of insufficient illuminating power of the lamps. The incandescent system was used. The city will now use gas.

Marengo, Ia.—A company has been organized to put in an electric light plant. Capital stock, $10,000.

Paris, Tex.—The Council Committee on Lighting wants propositions for lighting the city by electricity.

Brownsville, Tex.—Proposals are wanted for a plant of 1,000 incandescent lights. Address H. F. GRAY, Galveston.

New Castle, Col.—The New Castle Water, Light & Power Co. will put in an electric light plant.

Conduits.—At Denver, Col., an ordinance has been passed granting a franchise for the construction of underground conduits for electric wires.

Electrical Appliances.—The Fort Wayne Electric Light Co. has been organized to manufacture electrical appliances of all kinds. Capital stock, $3,000,000. Manager, R. T. MCDONALD.

SEWERAGE AND MUNICIPAL.

Joliet, Ill.—Mr. CHAS. H. LEDLIE, M. Am. Soc. C. E., of St. Louis, Mo., has presented his report on the sewerage of Joliet, with plans and specifications. He points out that some method of sewage disposal other than that of discharging it direct into the river will be required, and he recommends chemical precipitation and filtration combined. The separate system is recommended, storm water being drained off to the river and creeks. The sewage will be pumped to 6 settling basins with a capacity of 450,000 galls. each, and the sludge from these will be dried in presses and then dug into the ground, burned under the boilers at the pumping station or disposed of as other city garbage. The total cost for 5 trunk sewers, 3 basins, filter beds, 2 engines of 3,000,000 galls. capacity, machinery, plant, land, engineering and contingencies is estimated at $415,671. The annual cost of chemical treatment of sewage for a population of 30,000, or 30,000,000 galls. per day, is estimated at $19,334.

Street Work.—*Memphis, Tenn.*—Major MERIWETHER, City Engineer, has presented a detailed statement of the cost of granite paving on 3d St. The average cost for granite or limestone blocks on concrete foundation is from $3.90 to $4.25 per sq. yd., including labor, etc., for pavement complete.

Glendale, O.—A contract for cement walks has been awarded to the Gem City Paving Co., of Dayton, O., for $2,067.60.

Eau Claire, Wis.—The contract for 2 miles of cedar block paving has been awarded to Thomas Reilly, of St. Paul, Minn., at $40,200.

Denver, Col.—It is proposed to lay fire-brick paving on some streets. The cost is estimated at $2.25 per sq. yd., as compared with $2.50 for stone blocks (not including crossings), and $3 for asphalt.

Bonds.—The city of Omaha, Neb., will issue bonds for $3,000 for paving alleys, $29 500 for curbing and $155,000 for paving. Proposals for the purchase of these bonds will be received by JOHN RUSH, City Treasurer, until Aug. 26. The County Auditor, Cincinnati, O., will receive proposals until Aug. 24, for 54 $500 bonds for the Cincinnati & Harrison turnpike.

Sewers.—*Deering, Me.*—A report on the sewerage of the town has been made by Mr. J. HERBERT SHEDD, C. E., of Providence, R. I. He recommends that roof water and some amount of rain water be provided for, and that pipe be used up to 12 or 18 ins. diameter and brick for larger sizes.

Concord, N. H.—It is proposed to build sewers in ward No. 7 at a cost of about $11,000.

Washington, D.C.—Contracts for building sewers during 1889-90 have been awarded to W. H. Mohler, Reynolds & Largney, Ryan & Fitzgerald, John Cudmore, James McCandlish, M. Hine and M. F. Talty.

Thomasville, Ga.—The sewerage system is to be extended on Broad St.

Florence, Ala.—Address the mayor for particulars of the proposed system of sewerage.

Duluth, Minn.—The contract for the Fifth alley sewer has been awarded to M. Fitzgerald at $2,055.

Helena, Mont.—Propositions will be received by the City Clerk for leasing the sewer farm for a term of 5 years.

Los Angeles, Cal.—City Engineer EATON has published statements showing the advantages of the sewer system designed and laid out by him.

Victoria, B. C.—It is proposed to build a sewerage system at a cost of $500,000.

WATER-WORKS.

NEW ENGLAND.

Auburn, Me.—The Auburn Aqueduct Co. proposes soon to erect a pumping station. A new 13 in. main is now being laid to connect the old mains, near Wilson's pond, with the distribution system.

Boothbay Harbor, Me.—A stand-pipe is being built by the Porter Mfg. Co., of Syracuse, N. Y.

Great Falls, N. H.—An act to incorporate the Great Falls Water Co. has passed the Legislature.

Crystal Lake, N. H.—An act has passed the Senate incorporating the Crystal Lake Water Co.

St. Albans, Vt.—MARSHALL MASON, Superintendent, informs us they will lay 1,000 ft. of 4-in. pipe, set one hydrant and 4 valves.

Barton, Vt.—Work is to be commenced at once.

Richford, Vt.—Works have been completed. Estimated cost, $18,000.

Northampton, Mass.—About 2,000 ft. of 6-in. pipe is being laid.

Springfield, Mass.—The Hegeman & Oliphant Filter Co., of New York City, has made a proposition to put in an 8,000,000 gall. filtering plant for $64,000.—City Engineer SLOCUM is preparing plans for connecting Bond Brook, Belchertown reservoir, and Ax factory streams by a series of canals, to connect with one large main, which will convey the combined supply to the city and furnish water for domestic use. Ludlow water could then be dispensed with, the water drawn off and plans for improvements more easily made.

Worcester, Mass.—Entire reconstruction of the Wyman reservoir dam is reported to be necessary. It is 250 ft. long, and 10 to 20 ft. wide. The reservoir is located in Westminster, and has an area of 1,000 acres. The report was made by CHARLES A. ALLEN, City Engineer. He also recommends the immediate repair of the Blackburn and Gardiner reservoir dams.

Westfield, Mass.—Proposals will be received on Sept. 2, for $115,000 of refunding bonds. Bonds for that amount will mature on Oct. 1. The present water debt is $225,000. Address, CHAS. N. OAKES, Town Treasurer.

Woonsocket, R. I.—A new tank is being constructed, and 2¼ miles of mains will be added.

Phenix, R. I.—The new dam at North Situate has been destroyed.

Wakefield, R. I.—A stand-pipe is being erected. It is 30 ft. in diameter by 54 ft. high.

Woonsocket, R. I.—The Porter Mfg. Co., Syracuse, N. Y., is to furnish a stand-pipe for these works.

MIDDLE.

Troy, N. Y.—The report of the special committee recommending the laying of about 10,000 ft. of pipe, with the necessary valves and hydrants, has been adopted. Aldermen HALL and FALES have been appointed a committee to secure prices. Several meters will probably be added.

Lansingburgh, N. Y.—Work has been commenced on the dam for the distributing reservoir. The new intercepting reservoir is nearly completed.

Brooklyn, N. Y.—The following bids for improving the St. Johnlan reservoir have been received by E. B. CADLEY, Clerk of the Board of County Supervisors: Jas. W. Birkett, $39,672; Harris & Maguire, $48,500; Conrad Freel, $34,250, for granite instead of flagstone, $42,000. The address of all bidders is Brooklyn, N. Y.

Albany, N. Y.—All bids for completing the reservoir on Black river, near Westport pond, have been rejected by Superintendent of Public Works JAMES SHANAHAN. New proposals will be invited. The appropriation for this work is $45,000.

New York N. Y.—The Aqueduct Commissioners have requested the Mayor and Comptroller to consider the advisability of purchasing Jerome Park as a site for a new reservoir.

Camden, N. Y.—Extensions will be made in September. Address FRED. S. GAMBLE, Secretary.

Brooklyn, N. Y.—A 48-in. main from Ridgewood reservoir through Willoughby Ave. has been recommended by Chief Engineer VAN BUREN, and the report presented to the City Council. The plans, if adopted as presented, call for 22,200 lin. ft. of 48-in. cast-iron pipe, with specials; 3,700 lin. ft., 36 in., with specials; 530 lin. ft., 30 in., with specials, together with stop cocks, blow-off valves, vaults, and covers. Estimated total cost, $694,210.

Syracuse, N. Y.—The dam of the Eaton reservoir is reported to be unsafe.

Surveys of the Skaneateles and Otisco lake watersheds are being made by W. R. HILL, of New York City.

Clyde, N. Y.—Connections are being made for a domestic supply. The stand-pipe has been completed.

Baldwinsville, N. Y.—C. H. BALDWIN, Secretary Board of Water Commissioners, has received the following bids for building complete works: Wm. Patrick & Co., Phœnix, N. Y., $51,432.66; Leonard & Shepard, Scranton, Pa., $52,000; Francis S. Peeke, Watertown, N. Y., $67,640; Casey & Chambers, Rochester, N. Y., $50,000; J. H. Hauck, Herkimer, N. Y., $47,929.75; Phœnix Foundry Co., Syracuse, N. Y., $53,675; George G. Chauncey, Fulton, N. Y., $62,643.85; Brown Bros., Mohawk N. Y., $45,054.94. The contract was awarded to Brown Bros., of Mohawk, N. Y.

Albany, N. Y.—Several additional wells are being sunk.

Perth Amboy, N. J.—Works are projected.

Scranton, Pa.—J. B. FIKE, Superintendent, informs us a 24-in. main is being laid.

Penn Argyl, Pa.—Works are being built by a local company. A reservoir is to be built in the Blue Mountains. The supply will be furnished by springs. Pipe-laying has begun. Hydrants will be used.

Reynoldton, Pa.—Mains are being laid from the McKeesport works to supply this and other boroughs with water.

Du Bois, Pa.—Works are being built by C. J. SHUTTLEWORTH, of Springville, N. Y.

Wilkes Barre, Pa.—The Springbrook Water Co. has been organized to furnish a water supply. Capital stock, $500,000. The stockholders are: L. D. SHOEMAKER, LEWIS A. WATRES, L. AMERMANN, ABRAM NESBITT, DANIEL EDWARDS and THOMAS BEAVER. Their plan is to wholesale water to the local companies in all the towns in the Wyoming valley. Work will be commenced at once.

Washington, D. C.—Trenching for the large mains has been begun. THOMAS COWLE is the contractor. The new mains include about 20,000 lin. ft. of 48 in., 5,400 ft. of 30-in., and about 400 ft. of 24-in. The rate of progression in the work of excavating is fixed at 400 lin. ft. a day.

SOUTH ATLANTIC AND SOUTH CENTRAL.

Roanoke, Va.—The company is to extend its mains.

Abingdon, Va.—The contract for works has been awarded to the Glamorgan Co., of Lynchburg, Va.

Elkins, W. Va.—Works will probably be built. Address STEPHEN E. ELKINS.

Madison, Ga.—Works will be built. Address the Town Clerk.

Hinesville, Ga.—Plans for works will probably be completed soon. Propositions will then be wanted. Address the Town Clerk.

Leesburg, Fla.—The question of building works is being discussed. Address Mayor LEE.

Tampa, Fla.—The company proposes to take its supply from Magbee Springs. The present supply is from an artesian well.

Sheffield, Ala.—The contract for building works has been awarded to the Scovel & Irwin Construction Co., of Nashville, Tenn. The contract price is $100,000. Work will be commenced about Sept. 1.

Anniston, Ala.—The Anniston City Water-Works Co.'s plant has been purchased by the T. G. Brush Water-Works Co. The two systems will be connected and operated as one plant by the latter company.

Natchez, Miss.—The Natchez Water & Sewer Co. will sink artesian wells and furnish a water supply.

Meridian, Miss.—The Board of Aldermen has passed a resolution calling for a joint session of the two boards, to consider the propriety of declaring the water works contract with the city forfeited, or adopt measures to secure a pure water supply, as is provided for by the contract.

Amite City, La.—Works are projected. Address E. E. COOLEY, Chairman Water Committee.

Covington, Tenn.—S. C. SHELTON has sent us the following:

Works to cost about $10,000 will be built by the Covington Water Co. Water will be pumped from a spring to a tank. They are to be completed in May, 1890. No contracts have been made. Population, 1,500.

Brownsville, Tenn.—A. W. BROCKAWAY, Cashier Brownsville Savings Bank, has sent us the following information:

The town will welcome and aid men of capital to erect works. Correspondence with contractors is solicited by Mr. Brockaway.

Knoxville, Tenn.—A new company has been organized to furnish a sufficient water supply for 100,000 people. It will make a proposition to supply Knoxville, West Knoxville, and North Knoxville with water. Capital stock, $200,000.

Union City, Tenn.—A contractor has made a proposition to establish works.

Nashville, Tenn.—The Board of Public Works and Affairs, in its report to the City Council, recommends the immediate acceptance of the Henry R. Worthington proposal, to furnish a 10,000,000-gall. pump for $83,000, within 11 months. By the terms of this proposal the manufacturers agree to furnish a duplicate of this pump for $82,500, if ordered before Oct. 1, 1891.

Pineville, Ky.—H. C. LEE, Secretary, informs us that they are now building a 150,000 gall. reservoir. The works will be completed about Oct. 1.

Richmond, Ky.—The following information is from G. W. EVANS:

The town wants works and has been granted a charter to build them. This is a good opportunity for a reliable contractor.

Louisville, Ky.—Extensions are being made.

Sumter, S. C.—Plans and estimates for works are being secured. Citizens are ready to subscribe liberally as soon as money is needed. An effort is being made to combine them with the electric light plant, for which a contract has recently been awarded, and have the same machinery furnish motive power for both.

NORTH CENTRAL.

Upper Sandusky, O. W. W. TAYLOR, of Philadelphia, Pa., will probably take the contract which was awarded to the New Jersey company and construct the works.

Sidney, O.—The Porter Mfg. Co., of Syracuse, N. Y., has been awarded the contract to furnish the new stand-pipe.

Columbus, O.—General enlargement of the entire system is recommended by the Water-Works Committee.

Martin's Ferry, O.—The city water board will at once spend $5,000 in laying new mains.

Edinburg, Ind.—The town has no water supply. W. E. DOWNS is Town Clerk.

Terre Haute, Ind.—The extension of mains and addition of several hydrants is contemplated.

Howard City, Mich.—Works are projected.

Evarts, Mich.—About $9,000 is to be expended in improving the works. Address Chairman of Water Commissioners.

Muskegon, Mich.—The question of issuing $100,000 of bonds and building works has been defeated by a majority vote of 34. Controversy and division of public opinion as to the source of supply was the cause.

Kalamazoo, Mich.—GEO. H. CHANDLER, Superintendent and Engineer, informs us they contemplate building a foundation for a new pumping engine this fall. Also that they have laid 2¾ miles of 12, 8 and 6-in. pipe this season.

East Saginaw, Mich.—An 8,000,000-gall. vertical, triple compound Gaskill pump and two steel boilers will be erected this fall.

Grand Rapids, Mich.—The new stand-pipe is to be furnished by the Porter Mfg. Co., Syracuse, N. Y.

Holly, Mich.—The Town Council has voted to sink an artesian well to furnish a supply for the proposed works.

Ypsilanti, Mich.—A stand pipe will be furnished by the Porter Mfg. Co., of Syracuse, N. Y.

Albion, Mich.—The city has sold its issue of $50,000 of 30 years 5 percent. bonds, at 105 and accrued interest.

Havana, Ill.—Works are to be built. G. JAEGER is the contractor.

Belleville, Ill.—The City Water Co. has issued $600,000 of 20-year 6 per cent. bonds, dated Aug. 1, 1889, in favor of the Farmers' Loan & Trust Co., of New York.

Tuscola, Ill.—The question of building works is being discussed.

Rogers Park, Ill.—The Rogers Park Water Co. is now offering 7 year 6 per cent. first mortgage bonds for sale at 102 and interest. Address N. W. Harris & Co., of Chicago, Ill.

Canton, Ill.—J. T. ATWATER, City Clerk, informs us they are now laying 3,000 ft. of 6 and 8-in. kalamein iron pipe, and that they will set 6 or 8 hydrants.

Springfield, Ill.—H. H. BEECHER, Secretary, informs us they will add 1,000 ft. to their filtering tunnel this fall.

Duquoin, Ill.—The Council has voted to build works at once. Address, Mayor SOLOMON or Clerk F. V. NETTLETON.

Alton, Ill.—A settling basin with three compartments, for filtering the water, is to be constructed. EDWARD RUEGGER, Janesville, Wis., is the engineer. S. A. UNDERWOOD, of Boston, Mass., is Secretary of the syndicate owning the works.

Beloit, Wis.—A small amount of pipe will probably be laid this season.

Neillsville, Wis.—R. F. KOUNTZ, Secretary, sends us the following:

There is a prospect of a new pump and boiler being added, and other extensions made this fall.

Ashland, Wis.—WM. REINECKE, Secretary, 423 West Main St., Louisville, Ky., has sent us the following:

Extensions and additions to cost about $50,000 are being made. It includes laying 4,500 ft. of 24-in. suction pipe, and about 2 miles of 20, 16 and 12-in. pipe. The work will be completed in September.

Burlington, Wis.—Works are to be established. The supply will be taken from an artesian well.

Green Bay and Fort Howard, Wis.—The Green Bay & Fort Howard Water-Works Co. is now offering 6 per cent. bonds for sale. Address Parson, Leach & Co., of Chicago, Ill.

NORTHWEST.

Creston, Ia.—E. J. SIDEY, City Clerk, has sent us the following:

A franchise has been granted to A. L. STRANG, of Omaha, Neb.; he having 40 days in which to prospect for water before accepting it.

Marshalltown, Ia.—The artesian well which is to furnish a supply for the works has proved successful.

Emmetsburg, Ia.—We are indebted to A. C. YOUNG, Recorder, for the following:

Plans and specifications for works have been adopted by the Council, but no contracts have been let. Water will be pumped from a well to a stand-pipe. The estimated cost of works is $9,000. Population about 2,000.

St. Paul, Minn.—The water in Vadnais lake is unusually low, and there has been some talk of connecting Charles and Turtle lakes with Vadnais, Phalen, Pleasant and others of a chain of lakes which now furnish the supply. Also of sinking artesian wells to increase the supply of Lake Como. No definite plans have as yet been formulated.

Warrendale, Minn.—The supply is furnished by the St. Paul works.

Chatfield, Minn.—Propositions for sinking an artesian well, constructing a reservoir, and establishing works will soon be wanted.

Two Harbors, Minn.—WALTER W. CURTIS, St. Paul, Minn., engineer of the new works, sends us the following:

Fairbanks, Morse & Co., St. Paul, have been awarded the contract for furnishing cast-iron pipe at $30 per ton; specials at 4 cts. per lb.; 8-in. wrought iron pipe, $1.25 per ft.; Mathews hydrants at $38 each; 8-in. valve with box, $28; 6-in. valve with box, $18; 4-in. valve with box, $14; pump-house, pumping machinery and tower, $9,000.

St. Jacques & Filiabiault, of Two Harbors, laying 8, 6 and 4-in. pipe, 55 cts. per ft; setting hydrants, $3 each; 8-in. valves, $2; 6-in. $1.50; 4-in. $1. Pipes are to be buried 8 ft.

The tower is 20 ft. in diameter by 30 ft. high, placed on an 80-ft. wooden tower. The pump is a duplex high-pressure Smith-Vaile.

North St. Paul, Minn.—The new works will be completed about Sept. 1. The contractors are R. B. C. Bement & Co., of St. Paul.

Topeka, Kan.—JOAB MULRANE, Treasurer, informs us they contemplate laying 1½ miles of mains.

Fremont, Neb.—GEO. MARSHAL, Commissioner informs us they have recently let a contract for 5 miles of pipe, a new 1,500 000-gall. pump with boilers, and for putting down a system of drive wells. Estimated cost, $38,500.

Beatrice, Neb.—The Jewell Pure Water Co., of New York, is putting in a 1,000,000-gall. filtering plant. The supply is taken from the Blue river.

Osceola, Neb.—L. J. BLOWER informs us that they are investigating the question of establishing works.

Holdredge, Neb.—The difficulties between the contractor and the city have been adjusted by the city taking posses ion of the works.

Dodge, Neb.—CHAS. WOODRUFF, Village Clerk, informs us that they are now discussing the question of establishing works.

Gothenburg, Neb.—We are indebted to GEORGE COX, of Kearney, Neb., for the following information:

Contracts for building the Gothenburg canal will be let about Aug. 25 by the Gothenburg Canal Co. The estimated cost is $50,000; $17,000 has already been subscribed by citizens. The company has an authorized capital of $1,000,000. GEORGE COX is the Engineer.

Oakes, Dak.—J. E. SPURLING has sent us the following:

Contracts for a small system of works will be let about Oct. 1. The supply is to be taken from artesian wells. Estimated cost, $5,000. Population, 1,000.

Huron, Dak.—The City Council has ordered 2 miles of mains laid at once. Other improvements are to be made.

Tyndall, Dak.—E. TANGNEY, of Sanborn, Ia., has been awarded the contract to establish works. The contract price is $6,691.50.

Madison, Dak.—The City Council will vote on the question of issuing $10,000 of bonds on Aug. 29.

Douglas, Wyo.—We have received the following from M. C. BARROW, Town Clerk:

Contracts for works to cost about $13,500 will be let soon. The town has $6,500 on hand; the issuing of $7,000 of bonds will be voted on Aug. 15. Population is 900.

SOUTHWEST.

St. Charles, Mo.—The works have been tested and the pressure found to be insufficient for their protection.

St. Louis, Mo.—The plans submitted by Water Commissioner HOLMAN for new mains in Chautau Ave., will probably be adopted, and work begun soon.

Batesville, Ark.—F. D. DENTON has sent us the following:

A gravity system of works will be built by the Batesville Water Co. The supply will be taken from a spring. No engineer has been employed, and no contracts made. J. N. REED is President. Population 3,000.

El Paso, Tex.—Reports state that the city is threatened with a water famine. Propositions are wanted for furnishing a supply from artesian wells.

Greenville, Tex.—The works have recently been satisfactorily tested by CHAS. H. LEDLIE, Engineer, of St. Louis, Mo., and B. S. WATHEN, and will probably soon be accepted by the city. The pumping machinery is from the Buffalo (N. Y.) Steam Pump Co. There are two duplex compound condensing engines, one high pressure, with 12-in. cylinders, the other low pressure, with 22-in cylinders, each of 10¼-in. bore, 18-in. stroke. Combined capacity, 25,500,000 galls. The 15-ft. in diameter by 130-ft. high stand-pipe, and boilers, are from Shickle, Harrison & Howard, of St. Louis. The 800,000-gall. filtering plant was furnished by the American Filter-Co., of Chicago.

Pueblo, Col.—The Water-Works Trustees have ordered their engineer to proceed with the preparation of plans for the new reservoirs to be located 2 miles west and north of the town. The contemplated improvements will cost about $100,000. The improvements at the pumping station have just been completed, costing several thousand dollars.

Denver, Col.—The legal controversy between the Citizens and the Denver water companies, over the right to develop a gravity system of works on land in the Platte cañon has been decided in favor of the Citizens Water Co., which is a new organization. Steps will probably be taken to carry out their plans at once.

New Castle, Col.—We have received the following information from J. C. KENNEDY, Engineer, of Glenwood Springs, Col.:

The New Castle Water, Light & Power Co., will put in a gravity system of works. Part of its stock and bonds are now being offered for sale. Correspondence is solicited by J. C. KENNEDY, Box 310, Glenwood Springs, Col.

Santa Fé, N. M.—The city is very much in need of an adequate water supply. It is reported that the company has failed to provide for increased demands, and that individuals are about to sink wells and to establish independent supplies.

PACIFIC.

Port Townsend, Wash.—The following is from H. L. TIBBALS, Jr. Superintendent:

The construction of works will be begun about Jan. 1, 1890, by the Port Townsend Water Co. The supply will be taken from a creek and pumped to a reservoir. The present supply is from artesian wells. Estimated cost of complete works, $200,000. Population, 5,000.

Waitsburg, Wash.—The town wants works. Address the Town Clerk.

Chehalis, Wash.—The officers of the Chehalis Flume & Aqueduct Co., are: President, WILLIAM WEST; Vice-President, J. D. RICE; Secretary, N. B. COFFMAN; Treasurer, L. LAWRENCE.

Seattle, Wash.—A proposition to establish a Holly system of works for fire protection, flushing sewers, street sprinkling, etc., has been made to the city by the Holly Mfg. Co., of Lockport, N. Y. The cost of the works would be $109,877 50. The supply would be salt water taken from the bay. Should their proposition be accepted, a separate system for domestic supply would be established.

Anaheim, Cal.—The Anaheim Union Water Co. is negotiating with the Wright Irrigation District for the sale of 6,996 shares of stock at $16,000. The debt of the old company is $48,500.

Oakland, Cal.—J. S. Emery is securing rights to bring water from Lake Eleanor, in the Sierra Nevada mountains, to Oakland, a distance of 150 miles. The lake is located between the Yosemite Valley and Sonora. A reservoir will be constructed on a branch of the south fork of the Tuolumne river. ABNER DOYLE and F. C. DE LONG are interested in the project.

Santa Cruz, Cal.—Fourteen miles of mains will be laid. Estimated cost, $105,000. The total cost of the works is $300,000.

Ogden, Utah.—The City Council has contracted with the Bear River Canal Co., for a water supply. The city surrenders control of the entire city water system but reserves the right to repurchase the whole system. The company is to build a large canal, which will furnish water for irrigating 500,000 acres of land and supplying several cities. Surveys are being made.

Reno, Nev.—The Reno Water Co. has absorbed the Highland Ditch Co. The works are to be greatly enlarged and improved.

CANADA.

Chicoutimi, P. Q.—Surveys for a gravity system of works have been made by J. F. GUAY, of Quebec. No action has yet been taken by the council. The estimated cost is $27,000.

Montreal, P. Q.—The Water Committee will expend $5,000 at once on 6-in. mains.

St. Thomas, Ont.—The Special Committee, appointed to devise a scheme to procure water, have decided to engage the services of an expert to give his opinion of the feasibility of bringing it from the Lake Springs, 3 or 4 miles from the city, by gravitation.

Newmarket, Ont.—Bids will be received on Aug. 19, for furnishing pipe, lead, valves, hydrants, and specials for the proposed extensions; laying pipes and setting the valves and hydrants; or for furnishing all material and completing the work. H. S. CANE is Chairman Fire and Water Committee.

Niagara Falls, Ont.—Bids are wanted for the following work and material, by JOHN ROBINSON, Secretary Water Commissioners. Excavating about 600 ft. for head-race, chiefly in rock; excavating for wheel-pit; building masonry foundations; constructing 500 ft. wooden flume, 8 ft. in diameter; excavating about 125 ft. of tunnel in rock; digging trenches and laying about 6 miles of pipe. Also, for furnishing and erecting two sets pumping machinery, each having a daily capacity of 1,250,000-galls., with turbines, iron flumes, penstocks etc. WM. KENNEDY, Jr., is the Engineer.

Toronto, Ont.—Tenders will be received on Aug. 28 for building a high level pumping station. JAMES B. BOUSTEAD is Chairman Committee on Water Works.

Niagara, Ont.—Works are projected. Address the Town Clerk.

Chatham, Ont.—The question of building works is being discussed. N. H. STEVENS is Chairman of the Board of Trade. The following resolution has been offered by Alderman, PETER MCKELLAR:

That the Board recommend the council to offer the American company $10 000 per annum rental for their water, they to have the income from users; with 180 hydrants.

Windsor, Ont.—The new engine from Kerr Bros. has been satisfactorily tested.

Vancouver, B. C.—An additional well is being sunk to supply the garrison. A small pump will be needed.

ARTESIAN WELLS.

Melbourne, Fla.—A number of wells have been sunk in this vicinity; more are projected.

Jacksonville, Ill.—The well has reached a depth of 1,800 ft. There are no signs of water.

Chattanooga, Tenn.—The Lookout Mountain Hotel Co. has contracted with McKay & Cochran to sink a 500 ft. well with 5½ in. casing.

Moorhead, Minn.—The well is down 1,758 ft. Water has been found, but not in sufficient quantity.

Highmore, Dak.—Bids are wanted for sinking a well. The contract will be awarded to the lowest responsible bidder. Address, F. M. BARNES, Town Clerk.

Clearwater, Minn.—E. D. SHELDON has secured a good supply of water at a depth of 69 ft. The well is 1¼ ins. in diameter.

Winnipeg, Manitoba.—Reports state the Deloraine well will probably have to be abandoned, or the old hole enlarged to admit a large casing. It is now 1,100 ft. deep.

Santa Fé, N. M.—From an article in the *New Mexican* this appears to be a good field for artesian well and windmill contractors to explore. Address, E. D. FRANZ.

IRRIGATION.

The Arizona Canal Co.—Bonds for $25,000 bearing 8 per cent. interest are now being offered for sale. For particulars address Farson, Leach & Co., Chicago, Ill. The canal is situated in the Salt River valley. It is 40 miles long, 15 ft. wide and carries 40,000 miners' inches of water.

Grand Forks, Dak.—A syndicate has been formed by Bismarck, Grand Forks, and Jamestown capitalists, to construct a canal, which, with laterals, will reclaim 5,000,000 acres of land in North and South Dakota. It will take its supply from the Missouri river at Bismarck, 1,668 ft. above the level of the sea; thence to Traverse and Big Stone lakes, 900 ft. above the level of the sea.

Oakland, Fla.—J. G. SPEER is erecting a pumping plant for irrigating purposes.

San Francisco, Cal.—The following interesting statement is from the State Board of Trade Committee to the U. S. Senate:

There perhaps is no country in the world where so much land can be profitably irrigated without serious changes to the surface as in California. This condition extends from Mount Shasta on the north to Tejon Pass on the south, a distance of 500 miles. The two valleys of the Sacramento and San Joaquin cover an area of 12,000,000 acres of irrigable land. If reservoirs are constructed in the most favorable localities, and the running streams utilized, there is more than ample water in California to irrigate every foot of land susceptible of irrigation.

Topeka, Kan.—The Eureka canal, extending from Ingalls to Kinsley, Kan., a distance of about 100 miles, has been sold by ASA T. SOULE, of Rochester, N. Y., to an English syndicate for $1,000,000. The new organization will be known as the Kansas Water-Works & Irrigation Co., and have its headquarters at Spearreville, Kan. Its object is to build tributary canals and develop a vast additional territory along the line of the Eureka canal.

Dodge City, Kan.—The Dodge City Canal Co. and the South Dodge Canal Co. have been organized. The officers are: President, E. E. SOULE; Vice-President, G. G. GILBERT; Secretary and Treasurer, J. W. GILBERT. The combined capital stock is $850,000.

The south side canal will begin at a point on the Arkansas river 8 miles west of Dodge City and extend to Ford City. It will be 15 ft. wide on the bottom, 22 ft. on top and will carry 3½ ft. of water. The other ditch will have its source in the Arkansas river, on the east side of Dodge City, and will be 50 miles long. Its dimensions will be 20 ft. on the bottom, 32 ft. on top, draught 4½ ft. Both canals will be built at once.

Salt Lake City, Utah.—Surveys for the Bothwell canal are being made by JOHN R. BOTHWELL. The supply will be taken from the Bear river cañon, at the Narrows. A dam is to be built at this point which will raise the water 20 ft.

W. D. B. JAMES proposes to build a dam at the forks of the Big creek and use its western channel to convey water to the Bear Lake reservoir.